THE SECRETARY OF HEALTH AND HUMAN SERVICES
WASHINGTON, D.C. 20201

AUG 15 2005

The Honorable Richard B. Cheney
President of the Senate
Washington, DC 20510

Dear Mr. President:

I am respectfully submitting to Congress the enclosed report, entitled "Utilization and Beneficiary Access to Services Post-Implementation of the Inpatient Rehabilitation Facilities Prospective Payment System (IRF PPS)." This report is being submitted in response to requirements of section 125(b) of the Medicare, Medicaid, and SCHIP Balanced Budget Refinement Act of 1999 (Pub. L. No. 106-113) that mandates the Secretary to submit a report to Congress that evaluates the impact on utilization and beneficiary access to services after the implementation of the IRF PPS.

In the enclosed report, the Centers for Medicare & Medicaid Services details what steps the Department of Health and Human Services intends to take to improve and assess beneficiary utilization and access to services within the IRF PPS.

I am also sending a copy of this report to the Speaker of the House of Representatives.

Sincerely,

Michael O. Leavitt

Enclosure

THE SECRETARY OF HEALTH AND HUMAN SERVICES
WASHINGTON, D.C. 20201

AUG 15 2005

The Honorable J. Dennis Hastert
Speaker of the House of Representatives
Washington, DC 20515

Dear Mr. Speaker:

I am respectfully submitting to Congress the enclosed report, entitled "Utilization and Beneficiary Access to Services Post-Implementation of the Inpatient Rehabilitation Facilities Prospective Payment System (IRF PPS)." This report is being submitted in response to requirements of section 125(b) of the Medicare, Medicaid, and SCHIP Balanced Budget Refinement Act of 1999 (Pub. L. No. 106-113) that mandates the Secretary to submit a report to Congress that evaluates the impact on utilization and beneficiary access to services after the implementation of the IRF PPS.

In the enclosed report, the Centers for Medicare & Medicaid Services details what steps the Department of Health and Human Services intends to take to improve and assess beneficiary utilization and access to services within the IRF PPS.

I am also sending a copy of this report to the President of the Senate.

Sincerely,

Michael O. Leavitt

Enclosure

Report to Congress
Utilization and Beneficiary Access to Services Post-Implementation of the Inpatient Rehabilitation Facility Prospective Payment System

Michael O. Leavitt
Secretary of Health and Human Services
2005

Report to Congress on the Utilization and Beneficiary Access to Services Post-Implementation of the Inpatient Rehabilitation Facility Prospective Payment System

The Balanced Budget Act (BBA) of 1997 (Pub. L. No. 105-33), as amended by the Medicare, Medicaid, and SCHIP Balanced Budget Refinement Act (BBRA) of 1999 (Pub. L. No. 106-113) and the Medicare, Medicaid, and SCHIP Benefits Improvement and Protection Act (BIPA) of 2000 (Pub. L. No. 106-554), authorizes the Secretary to implement a Prospective Payment System (PPS) for Inpatient Rehabilitation Facilities (IRFs). IRFs began to be paid under the PPS on the first day of their fiscal year (FY) that started on or after January 1, 2002. Prior to the IRF PPS, IRFs were paid using a historical cost-based system in accordance with Section 101(a) of the Tax Equity and Fiscal Responsibility Act (TEFRA) of 1982 (Pub. L. No. 97-248).

Under the IRF PPS, Medicare pays facilities a pre-determined rate per discharge. This rate varies by case mix group (CMG). The CMG depends on the patient's impairment, motor functional performance at admission, comorbidities and, for some CMGs, also a patient's age and/or cognitive status. In addition, special rates apply for patients who die in the IRF; patients who are considered short-stay transfer patients, with atypically short-stays; and patients who are considered high cost outlier patients. The rates also account for facility characteristics such as area wages, the share of a facility's patients with low incomes, and rural location. The Center for Medicare & Medicaid Services (CMS) has updated the IRF PPS rates for each Federal FY since January 1, 2002, as mandated by section 1886 (j) of the Social Security Act.

To inform Congress regarding the implementation of the IRF PPS, section 125(b) of the BBRA mandates the Secretary to submit a report that evaluates the impact on utilization and beneficiary access to services after the implementation of the IRF PPS.

In order to prepare this report, the CMS contracted with the RAND Corporation (RAND) to study the anticipated and observed effects of the IRF PPS. This report captures the major findings from the RAND research. RAND focused their research on two areas:

1. Changes in beneficiary access to care, and;
2. Responses to specific incentives created by the IRF prospective payment system.

One goal of the IRF PPS is to ensure access to IRF care by compensating IRFs based on their case mix. The TEFRA payment system capped per discharge payments to an IRF at a facility-specific maximum that was determined using estimated facility-specific costs in the IRF's base year of operation. Under TEFRA, there was no adjustment to payments due to changes in an IRF's case mix following the base year. Thus, updates to the rates did not keep up with inflation, which allowed newly classified IRFs to obtain larger payments than existing IRFs. The lack of case mix adjustment under TEFRA opened up incentives for providers to preferentially admit relatively less expensive cases, thus raising concerns that TEFRA may limit beneficiary access. The IRFs also took advantage of incentives under TEFRA to maximize payment. This led to increased utilization and costs during the base year(s), as well as afterward, relative to pre-TEFRA years, thus resulting in increased expenditures for the Medicare program (Chan et al.,

1997). By 1995, payments exceeded costs by seven percent in freestanding rehabilitation facilities and four percent in rehabilitation units (MedPAC, 1998).

The shift from a cost-based system to a PPS encourages facilities to provide care efficiently because they can retain any difference between the prospectively set payment amounts and their costs. However, facilities may also modify their care and practice patterns and possibly modify their coding practices to increase revenue. For example, facilities could modify the way patients are assessed and how their diagnoses and functional performance are coded, modify treatment intensity and length of stay (LOS), modify their internal transfer policies, and modify their admissions policies. In addition, some changes coinciding with the new PPS could be due to other Medicare rules or other changes taking place in the health care system. Regardless of the causes of changes, such changes in practice patterns could have either adverse or beneficial effects on patients and/or cause unwarranted increases in Medicare expenditures.

In this report, we begin with a descriptive analysis of utilization patterns, followed by in-depth examinations of behavioral responses to IRF PPS policies for interrupted stays and resource use. Appendix I provides a descriptive analysis of utilization patterns, behavioral responses to the IRF PPS policies regarding interrupted stays and resource use, changes in the average length of stay (ALOS), coding changes, and payment-to-cost ratios. Appendix II on post-acute care (PAC) access examines the cumulative effects of PAC payment changes on patient access to care. Appendix III examines the effects of the IRF PPS on patient access to care by comparing the severity of IRF patients before and after the IRF PPS.

Payment System Changes

It is important to understand the current IRF PPS and the possible incentives of the payment system before we can discuss the monitoring research findings. The BBA, as amended by the BBRA and the BIPA, provided for a per discharge PPS. The IRFs began to be paid under the PPS on the first day of their FY that started on or after January 1, 2002. Thus, some facilities were subject to the system immediately, while other facilities were not subject to the system until December 2002. Regardless of when a facility began receiving payments under the IRF PPS, all IRFs were required to submit patient assessment forms beginning on January 1, 2002.

Under the IRF PPS, the payment amount is adjusted by a CMG. There are 100 CMGs. The data used to assign a CMG to an IRF patient come from the IRF Patient Assessment Instrument (IRF-PAI). In order to assign a CMG, each case is first classified into one of 21 Rehabilitation Impairment Categories (RICs). Most RICs are based on particular body structures and/or causes of functional loss. Ninety-five of the 100 CMGs are linked to the 21 RICs. The other five CMGs were based on data analyses created to allocate payment due to a unique set of circumstances such as very short-stays and cases where the patient expired.

Each RIC is subdivided into CMGs based on the patient's motor functional performance and in some instances the patient's age and cognitive performance. Motor and cognitive functional performance is determined by coding 17 items on the IRF-PAI. Collectively, these 17 items are known as the Functional Independence Measure™ (FIM) instrument. There are 12 FIM items used to determine a motor score, and five FIM items used to determine a cognitive score.

Depending on the RIC, the values of motor and cognitive scores and/or patient age determine the patient's CMG assignment within a RIC. The CMG assignment rules were derived in order to maximize the ability to predict cost, with the constraint that payment for care of a patient with a lower score (less independence) is never less than for care of an otherwise similar patient with a higher score.

Comorbidities are used to split the CMGs into four payment tiers. Each tier acts to modify the base (that is, unadjusted) CMG payment rate amount. Once a CMG is determined for the IRF patient, the payment is also adjusted to account for geographic variations in wages (wage index), the percentage of low-income patients, and location in a rural area.

There are situations where a unique set of circumstances arise in determining a patient's CMG. The original CMG assigned to the patient may be reassigned to better account for IRF costs for these unusual cases. In accordance with the *Federal Register* published on August 7, 2001 (66 FR 41316), cases that are reassigned to a different CMG may be one of the following situations:

- Short-stay transfer cases are patients with a stay less than the ALOS for their assigned CMG and are discharged to another institutional site of care. A short-stay transfer case receives a per diem payment for each day the patient is in the IRF plus one half-day per diem, where the amount of the per diem depends on the patient's CMG.
- Short-stay outlier cases are patients that are not considered short-stay transfers, stay less than three days, and are discharged alive. These cases are assigned a new CMG number.
- Patients that expire are classified into one of four special CMGs. This determination is based on the LOS and whether the discharge falls within an orthopedic or non-orthopedic RIC.

The payments for these unique circumstances described above are calculated when the fiscal intermediary processes the bill.

Provider Responses to Prospective Payment System

According to Ellis and McGuire (1996), the implementation of prospective payment can trigger a range of effects among providers. For example, providers can reduce the amount of care delivered, such as reducing therapy intensity. Providers can also engage in selection behavior, such as restricting their admission policies to restrict access for patients not likely to be profitable. Or, providers can alter their coding practices to record more patient functional limitations in order to increase payments without changing their case mix; this could occur in the form of deliberate upcoding or in response to changes in coding instructions or better training of coding staff, as well as incentives under the new payment system to thoroughly code patients' limitations.

Although the examples noted thus far represent negative provider responses, we also note positive responses by providers. For example, providers might respond to prospective payment by becoming more efficient and producing equivalent health outcomes with fewer inputs. In addition, providers who experienced fiscal pressure under the former payment system may be

able to admit patients with more severe illnesses or who have a lower motor and cognitive performance. Thus, the higher payments that account for the more clinically complex patients relieve the fiscal pressure due to policies of the former payment system.

In a large nationally representative sample of Medicare beneficiaries from 297 hospitals, Kahn et al. (1992) found that the LOS after implementation of the PPS for acute care hospital inpatient services dropped significantly for all of the conditions studied despite patients' lower health status at admission post-PPS versus pre-PPS. Kahn et al. (1992) also found greater instability among patients at discharge following implementation of the PPS. Neu and Harrison (1988) found that this observed decrease in the average length of an acute care stay was accompanied by increases in skilled nursing facility (SNF) and home health agency (HHA) utilization following an acute care stay. This finding indicates the potential for a shift of care from the acute care hospital to other settings.

Other studies look at the effect of the BBA of 1997 on post-acute care use. For example, Angelelli et al. (2002) found that the LOS and readmission rates of the costliest, most severely ill patients discharged to nursing facilities in Ohio post-BBA versus pre-BBA were steady over time while Yip et al. (2002) found decreases in the intensity and duration of physical and occupational therapies among Medicare beneficiaries in three southern California SNFs. White (2003) similarly concluded that the proportion of patients in freestanding SNFs receiving high levels of therapy declined after the SNF PPS was implemented.

Selection behavior effects have been found as well. In a small sample of Medicare beneficiaries in three southern California SNFs following implementation of the SNF PPS, Yip et. al. (2002) found that patients admitted post-PPS had conditions with better defined (i.e. , more predictable) care protocols, though patients had worse scores on health-related quality of life and functional status but better scores on emotional health. Newhouse (1989) found that patients discharged from an acute care hospital with a payment that was relatively less generous were increasingly admitted to "last resort" public hospitals.

Another study looked at coding changes that occurred after the implementation of prospective payments. One-half of the increase in the case mix index of Medicare patients at acute care hospitals in FYs 1987 and 1988 was attributed to changes in coding and administrative practices, resulting in increased Medicare expenditures (Carter, Newhouse, and Relles, 1991). Coding changes were expected following the IRF PPS because providers did not previously have an incentive to thoroughly code patient comorbidities; comorbidities garner additional payments under the IRF PPS, whereas they did not under the TEFRA system. The IRF-PAI, which collects patient admission and discharge information on functional performance, which is used to determine payment under the IRF PPS, was slightly modified from the FIM™ Instrument that was used prior to the IRF PPS. These changes could also have led to the coding changes.

RAND's Role in Monitoring the Inpatient Rehabilitation Facility Prospective Payment System

In monitoring access to care, RAND looked at trends in the use of IRF care and in overall post-acute care use, monitored the types of beneficiaries accessing post-acute care, and reviewed data concerning how payment changes may have affected beneficiary access to post-acute care. As mentioned above, the shift from cost-based to prospective payment gives facilities incentives to provide care efficiently because they can keep any difference between the prospective payment amounts and their costs. However, it may also give facilities incentives to selectively treat patients who are expected to have below-average costs within a payment category. Consequently, RAND also monitored whether certain types of patients experienced reduced access to care.

Appendix II and III on access to care address the Congressional mandate for a study of IRF patient access to care. As noted in Appendix III, RAND also conducted a series of analyses that addressed IRF utilization patterns, special payments for atypical patients, resource use in IRFs, and coding changes. These analyses are summarized in this report and presented in detail in the attached appendices.

Beneficiary Access to Post-Acute Care

In 1997 when Congress mandated the development and implementation of the IRF PPS for post-acute care providers, a concern was that post-acute care providers would respond in ways that would reduce beneficiary access to care as each post-acute care provider payment system was implemented. This was a major concern, particularly with regard to severely ill patients who may be less profitable than typical patients under these systems, i.e. there was concern about selection. In addition, there were concerns that the post-acute care PPSs would cause shifts in the provision of care across sites.

Appendix II on post-acute care access examines the cumulative effects of these payment changes on patient access to care. The post-acute payment system changes studied were the IRF PPS, HHA Interim Payment System , the SNF PPS, and the HHA PPS. RAND examined "realized access" by measuring utilization of Medicare-paid cases in IRFs, SNFs, and HHAs, and assessing how utilization changed in response to these PPSs as they were enacted in the late 1990s and early 2000s. For each payment system, RAND looked at both the immediate effects of the payment system on the use of the site of care it affected directly, and the longer-term effects of the payment system. In order to account for potential substitution across sites, RAND also examined the effects that changes to one payment system had on alternative sites of care. Finally, for each site of care, RAND considered whether access to care for severely ill patients declined more than for other patients as a result of the implementation of the PPS.

Appendix II focuses on Medicare patients over age 65, discharged from acute care hospitals between 1996 and 2003, with a diagnosis of hip fracture, stroke, or lower extremity joint replacement. Statistical models were used to predict the probability of patients going to a post-acute care location (no post-acute care, IRF, SNF, or HHA) before and after each payment system was enacted, controlling for underlying trends in post-acute care use, patient

characteristics, and discharging hospital characteristics. RAND assessed the importance of the payment system changes in the choice of post-acute care site by simulating how much each payment system changed the predicted probabilities of Medicare patients being admitted to an IRF, a SNF, or receiving treatment from an HHA.

RAND found that the effects of the differing payment systems on the use of post-acute care varied. RAND found that the payment system changes that were intended to contain costs had the effect of decreasing the use of a post-acute care site that was directly affected. But in many cases, they also had the effect of increasing the use of alternative care sites (as described below). For example, there was a marked decline in the use of home health care with the implementation of the HHA IPS, which persisted for stroke and joint replacement patients in the period following its implementation. Similarly, the implementation of the SNF PPS was associated with a significant decline in SNF use for hip fracture and joint replacement patients and an increase in HHA use over time for stroke, joint replacement, and hip fracture patients. As anticipated, even use of the HHA decreased with the implementation of the HHA PPS for all three conditions. In the period after the HHA PPS implementation, stroke patients' use of SNF care increased. Later, implementation of the IRF PPS was also associated with greater use of IRF care for joint replacement patients and a greater use of SNF care (with corresponding lower rate of discharge to the home or home health care.) The probability of patients with a hip fracture being discharged to the community without Medicare covered post-acute care – versus to an IRF, SNF, or HHA – is falling over this time period, while increasing for stroke patients and remaining about the same for joint replacement patients.

For severely ill patients, there was virtually no differential effect on access to care associated with any of the payment systems. However, RAND did find one potential reason for concern because the most pronounced effects of all the PPSs combined (though not specifically the IRF PPS) were observed for stroke patients. Stroke patients are the group for whom there is the most evidence that aggressive post-acute rehabilitation at any post-acute care site of care produces better outcomes. Overall, most of the payment system changes that were intended to contain costs had the effect of decreasing the use of the site of care directly affected. But in many cases, payment system changes also had the effect of increasing the use of alternative care sites. These changes do not appear to have affected the severely ill more than others. Technical details can be found in Appendix II.

Case Severity

As previously mentioned, providers could potentially respond to prospective payment by engaging in selection behavior (i.e., by changing admission policies to restrict access for patients who are likely less profitable than others). Appendix II on general access to post-acute care sites addresses this question across IRFs, SNFs and HHAs. To further address this question, RAND specifically studied changes in IRF case severity. RAND used two methods to define severely ill patients. One method was to define patients as severe relative to others if they had less than average functional status or greater than average resource use. The second method was to select patients with particular conditions, such as ventilator dependence, dialysis, or organ transplants, based on the relative costliness of these conditions. RAND used these definitions in deriving the candidate severity measures for the analysis.

RAND examined the effects of the IRF PPS on patient access to care by comparing indicators of patient access measured before and after the IRF PPS implementation. RAND focused on measures of resource use and patient characteristics to understand whether IRFs selected less expensive and less medically severe patients under the IRF PPS. In so doing, RAND derived several candidate measures of severity, including the prevalence of conditions selected for costliness and indicators of whether a patient was expected and/or observed to be "less profitable" relative to other patients with the same CMG and comorbidity status.

RAND did not find that patients treated at IRFs were appreciably more or less severely ill following the IRF PPS implementation than before; patients under the IRF PPS were to have only slightly higher costs per case than those in 1999. The level of case severity among IRF cases appears to have remained steady between 1999 and 2002, as indicated by the similar prevalence of specified high-cost conditions in IRFs in these two years and by the similarity of the predicted probabilities of IRFs having relatively severe cases in 1999 and 2002. Furthermore, the observed decrease (about 5.8 percent) in the ALOS in IRFs between 2001 and 2002 does not appear to be an abrupt response to the IRF PPS, but rather could be the extension of a downward trend that began well before 2002. Technical details can be found in Appendix III.

Change in Case Mix and Coding

As previously described, providers could also potentially respond to prospective payment by altering their coding practices of patient impairment in order to increase payments without changing their case mix. This may take the form of deliberate upcoding, or may simply be a response to changes in coding instructions and incentives under the new payment system to thoroughly code patients' functional limitations. For example, many hospitals may now code the worst functional level found in a patient at anytime during the assessment interval. Changes in the payment amounts should accurately reflect changes in IRFs' patient case mix—that is, the true cost of treating patients—and not be influenced by changes in coding practices. Otherwise, such coding changes could overstate IRF resource needs and not reflect actual changes in patient costs.

In a RAND refinement report, RAND's analysis in this area addresses two key questions:

1. How much did the case-mix index (CMI) change between 1999 and 2002?
2. If the CMI changed, to what extent were the changes due to changing patient case mix or to changes in coding?

RAND estimated that the CMI, as measured by the relative case mix weight per discharge, was approximately 3.4 percent higher in 2002 than in the 1999 data used to normalize the weights. RAND found that this change was largely unrelated to resource use and primarily related to coding changes. Coding caused between 1.9 percent and 5.8 percent of the increase in weight per discharge. Correspondingly, RAND estimated that the range of real change in case mix was somewhere between a decline of 2.4 percent (if coding caused a 5.8 percent increase since 1999)

and an increase of 1.5 percent (if coding caused only a 1.9 percent increase). Therefore, the change in relative weights indicates an average increase in payment.

Inpatient Rehabilitation Facility Utilization Patterns

RAND also examined the patterns of utilization of IRF care for evidence of changes. Patterns in IRF care observed in the analysis of 2002 data were largely consistent with the incentives created by the IRF PPS and with trends previously observed from 1996 through 1999. The data showed an increase in the number of IRFs caring for Medicare patients and a larger increase in the number of Medicare beneficiaries seen in IRFs between 1999 and 2002 in both absolute terms and on a per eligible beneficiary basis. There was also a shift in the composition of patients and/or coding of patients seen in IRFs after the implementation of the IRF PPS, as discussed above. A greater proportion of patients were coded as having comorbidities, and motor and cognitive functioning scores declined. RAND's work on overall IRF utilization patterns is presented in further detail in Appendix I.

Unusual Cases

Specific types of patients with atypical stays were examined to see if the IRF PPS might be providing incentives to shift these patients across sites. Under the IRF PPS, typical cases are defined as those that stay more than three days, receive a full course of inpatient rehabilitation, and are discharged to the community. Special payment rules apply to most atypical cases that deviate from this pattern. Certain behavioral changes likely occur in response to these rules as IRFs strive to maximize net revenue. The incentives are specific to the payment policies for unusual cases and may interact with other incentives to reduce costs and increase revenues.

Precise estimates of changes in transfer rates, and therefore also of atypically short stay cases, are problematic because of inconsistencies in the definitions used in the 1999 baseline data to report transfers and the under-reporting of short stay cases. However, RAND employed the best available method for making comparisons.

We found that IRFs responded in anticipated ways to the financial incentives created by the various policies for unusual cases. In particular, we found:

- A reduction in non-transfer stays lasting fewer than three days and an increase in non-transfer stays lasting four to five days. The proportion of non-transfer cases that are considered very short stay cases declined by about ten percent.
- Increases in both overall transfer rates and short-stay transfer rates. Because of data difficulties, it is not possible to determine if there was a decrease in short-stay transfers relative to long-stay transfers that are paid similar to typical cases.
- A reduction in the proportion of stays lasting fewer than three days and an increase in the proportion lasting four to five days. With the increase in transfer rates to acute care hospitals, we expected to find a parallel increase in stays that are paid as separate discharges. However, contrary to our expectations, we found that the overall rate of stays

lasting ten or fewer days declined slightly, which indicates that fewer of these patients returned for additional IRF care.

Freestanding IRFs showed stronger behavioral responses than IRF units of acute care hospitals to the incentives created by the payment policies for very short stays, transfers, and interrupted stays. However, freestanding IRFs have less access to the kind of advanced clinical resources to care for more complex patients than IRF units have. Thus, freestanding IRFs are more likely to need to transfer or discharge patients. These responses, in combination with other actions to reduce costs and increase revenues, have led freestanding IRFs to have lower costs per discharge and higher payment-to-cost ratios for unusual cases than IRF units. For interrupted stays, the payment-to-cost ratio for freestanding IRFs was 1.07 compared to 0.89 for IRF units of acute care hospitals. Consistent with having lower costs per discharge, freestanding IRFs received 1.2 percent of total payments as outlier payments compared to four percent for IRF units of acute care hospitals.

Overall, outlier payments were three percent of total payments. This approximates the three percent used to establish the initial outlier threshold. It appears that the behavioral responses to the IRF PPS were sufficient to offset possible increases in outlier payments attributable to the use of outdated cost-to-charge ratios to estimate costs. All else being equal, outlier payments may decline in the future as IRFs continue efforts to reduce costs per case and as cost-to-charge ratios reflect more current cost data. These results and a description of the methods can be found in Appendix I.

Resource Use

As previously discussed, providers can respond to prospective payment by becoming more efficient and/or by reducing the amount of care delivered, since they can keep any difference between the prospectively set payment amounts and their costs. RAND looked at changes in IRF LOS, costs (including therapy costs), and PTC ratios to determine how the IRF PPS may be affecting resource use in IRFs.

RAND's data analysis shows that the ALOS in IRFs has been declining from 1998 to 2002 (Table 1). From 1998 to 2002, there was a particularly large decline in the number of cases with extremely long LOS, and an increase in the percentage of cases in most payment groups discharged at the ALOS. Between 1998 and 2002, the number of cases with LOS longer than 20 days decreased from 24 percent to 5 percent. The rate of change in ALOS accelerated after 1998; between 1999 and 2002 it decreased by 12.8 percent, or almost 2 days. ALOS declined 5.8 percent from 2001 to 2002, the first year of the PPS. ALOS declined within each RIC between 1999 and 2002, the two years for which we have case mix data. The rate of decline in LOS varied across groups of hospitals. In general, hospitals that had long LOS in 1999 had greater percentage declines between 1999 and 2002, thus increasing the uniformity of IRF LOS across the country and across types of hospitals. These findings are consistent with our expectations because the IRF PPS is designed to pay based on the ALOS for each CMG.

Table 1: Mean Length of Stay of Bundled Discharges, By Year

Year	Mean LOS	% Change from previous year
1998	15.48	
1999	15.06	-2.69
2000	14.58	-3.18
2001	13.95	-4.35
2002	13.14	-5.81

Source: Table 5.1 of Appendix I.

The average cost per case declined by 0.6 percent between 1999 and 2002. Since LOS declined by a much greater percent, the cost per day increased by 14.1 percent. Thus, some of the savings from the decrease in the LOS went to providing more resources during the time the patient was in the IRF. Therapy costs per day increased at a lower rate (8.6 percent) than other costs in the same period, thus decreasing the percentage of costs devoted to therapy from 24.4 percent to 23.2 percent. The rate of change in average costs per case, cost per day, and PTC ratios also varied across groups of hospitals. Unlike LOS, daily costs did not become more uniform across hospital groups or regions. For example, freestanding cases cost approximately $200 more than cases in units in 1999. By 2002, freestanding IRFs cost $750 less than IRF units. If all IRF hospitals were paid based on 100 percent of the PPS rates throughout all of 2002, PPS payments during 2002 would have been 17 percent higher than costs. This is due to the lack of cost growth per case since 1999, the increase in the payment rate by the actuary to account for payment trends under TEFRA, and changes in coding. PTC ratios varied across groups of hospitals, with the largest values being for freestanding and proprietary IRF hospitals (1.26 and 1.28 respectively). In contrast, units had a PTC ratio of only 1.11. Despite the fact that freestanding IRFs had much lower costs in 2002 than IRF units, they had longer ALOS. Therefore, it remains possible that the PTC ratio of units was affected in part by accounting practices left over from the TEFRA era when hospitals had an incentive to increase the costs allocated to units.

The PTC ratios for other groups of IRFs showed the effectiveness of the payment adjustments, with only small variations between rural and urban areas, and by disproportionate share hospital (DSH) categories. Although payment largely followed costs by RIC and tier, variations in the PTC ratios across these categories showed additional analysis may be warranted. There also was a positive correlation between PTC ratio and hospital CMI quartile. In addition to demonstrating that the relative weights used to determine payments in the PPS do not reflect coding practices prevalent in 2002, this may indicate that coding practices varied across hospitals, with those in the highest CMI quartile responding most completely to the PPS incentives. The changes may also be indicative of upcoding. More details can be found in Appendix I.

SUMMARY

In general, RAND found that IRFs responded to the IRF PPS in predictable ways. For example, they modified coding practices and coded more comorbidities, modified their transfer and interrupted stay policies to substitute four and five day stays for shorter stays, and increased the overall rate of transfers. However, the modifications did not appear to have large effects on beneficiary access to IRF services or on the types of patients cared for in IRFs. Even the more severely ill patients, who would likely be more expensive for IRFs to treat, did not appear to experience declines in access to IRF care before and after the IRF PPS. The ALOS in IRFs declined significantly between 1999 and 2002, but this was likely part of a trend started before the IRF PPS rather than an abrupt response to it. The outlier policy for IRFs generally appears to have met the objectives set out in the implementation of the PPS. Finally, if all IRFs had been paid based on 100 percent of PPS for all of 2002, RAND's evidence indicates that PPS payments to IRFs would have been at least 17 percent more than their costs.

Attachments

Appendix 1

IRF Care Use Before and After Implementation of the IRF PPS

Completed Under Contract DRR-3325-CMS

This report was prepared under contract with RAND Corporation by Melinda Beeuwkes Buntin, Grace M. Carter, Orla Hayden, Carrie Hoverman, Susan Paddock , and Barbara Wynn.

Preface

Since the inception of the Inpatient Rehabilitation Facility Prospective Payment System (IRF PPS) in 2002, RAND has been contracted by the Centers for Medicare and Medicaid Services (CMS) to support its efforts to monitor the effect of the IRF PPS. To date, RAND has provided a number of analyses and reports on patient access to and utilization of IRF services before and after the implementation of the IRF PPS. Our reports address the Congressional mandate for a study of IRF patient access to care.

This report focuses specifically on how the implementation of the IRF PPS has affected the characteristics and resource use of patients seen in IRFs and IRF practice patterns. This report was prepared for CMS, but should also be of interest to individuals in the health care and policy-making arenas who are concerned about Medicare beneficiaries' access to care.

This work was sponsored by CMS under contract 500-2004-00033c and carried out under the auspices of RAND Health, a unit of the RAND Corporation. Comments or inquiries should be sent to the first author of this report, Melinda Beeuwkes Buntin (Buntin@rand.org). We would like to thank reviewers Dan Relles and Korbin Liu, and our project officer Jeanette Kranacs for helpful comments and suggestions. For more information about RAND Health, please visit <http://www.rand.org/health/>. The mailing address is RAND Corporation, 1776 Main Street, Santa Monica, CA 90407-2138. More information about RAND is available at http://www.rand.org.

Table of Contents

Preface i
Table of Contents ii
Tables and Figures iii
Chapter I. Background and Executive Summary 1
1.1 Payment System Changes 2
1.2 Provider Responses to PPS 3
1.3 Monitoring the IRF PPS 5
1.4 IRF Utilization Patterns 5
1.5 Unusual Cases 6
1.6 Resource Use 7
1.7 Limitations 9
Chapter II. Data 10
2.1 Data Sources 10
2.2 Sample Selection and Sample Size 12
Chapter III: Overall Utilization Patterns 14
3.1 Overview 14
3.2 Methods 14
3.3 Results 15
3.4 Conclusions 17
Chapter IV. Unusual Cases 19
4.1 Very Short-stay Discharges 21
4.2 Interrupted Stays 21
4.3 Short-stay Transfers 24
4.4 High Cost Outliers 26
4.5 Discussion and Conclusions 28
Chapter V. Resource Use 30
5.1 Distribution of Length of Stay of IRF cases 30
5.2 Changes in resource use by types of IRF 32
5.3 Payment-to-cost ratios in 2002 35
5.4 Conclusions 37
Appendix 1: CMI Calculation 39
References 41

Tables and Figures

Figures

Figure 3.1: Percent of IRF Cases by RIC, 1999 vs. 2002
Figure 3.2: Mean Motor Score by RIC, 1999 vs. 2002
Figure 3.3: Mean Cognitive Score by RIC, 1999 vs. 2002
Figure 3.4: Cumulative Distribution of All Cases in RIC 1 (Stroke) by CMG, 1999 versus 2002
Figure 3.5: Comorbidity Tier Assignments for All Hospitals, for All Cases in 1999 and 2002, and for IRF PPS Cases in 2002: by Freestanding/Unit Status
Figure 5.1: Cumulative distribution of LOS, by year

Tables

Table 2.1: Number of cases in each year in the longitudinal analyses
Table 2.2: Counts of IRF PPS Discharges During CY 2002 Excluded from Sample and Remaining Sample, by Reason for Exclusion
Table 2.3: Number of 1999 bundled discharges in population and sample with case mix data, by unit and freestanding and sample weight
Table 3.1: Increases in the Volume of IRF Facilities and Bundled Discharges, 1996-2002 (Excluding Maryland Hospitals) Versus Increases in the Fee-For-Service Discharges
Table 3.2: Distribution of Cases Across RICs for all Cases in 1999 and 2002, and for IRF PPS Cases in 2002: by Freestanding/Unit Status
Table 3.3: Mean FIM(TM) Motor and Cognitive Scores for All Cases in 1999 and 2002, and for IRF PPS Cases in 2002: by Freestanding/Unit Status
Table 3.4: Percent of Cases by RIC in Each Comorbidity Tier: All Cases in 1999 and 2002, and for IRF PPS Cases in 2002
Table 3.5: Change in Case Mix Index (CMI) between 1999 and 2002
Table 3.6: Demographic distribution of the matched sample cases by year: Percent of cases in each category.
Table 4.1: Very Short Stay Cases Discharged Alive by Length of Stay 1999-2002
Table 4.2: Distribution of Interrupted Stays: 1999-2002
Table 4.3: Distribution of Interrupted Stays by Hospital Characteristics
Table 4.4: 2002 Bundled Stays by Hospital Characteristics
Table 4.5: Changes in Transfers Measured by Post-IRF Status
Table 4.6: Transfers by Discharge Destination
Table 4.7: Simulated IRF-PPS Payments for All 2002 Bills Assuming 100% Federal Rate by Hospital Characteristic
Table 4.8: Simulated IRF-PPS Payments for All 2002 Bills Assuming 100% Federal Rate by RIC and Comorbidity Tier

Table 5.1: Mean LOS of bundled discharges declined each year between 1998 and 2002 and recently declined more in freestanding facilities than in units, although freestanding facilities continue to have larger mean LOS
Table 5.2: Mean length of stay declined between 1999 and 2002 in almost all RICs and typically declined more in freestanding facilities than in units, although LOS within most RICs remains higher in freestanding facilities
Table 5.3: Comparison of volume, cost, and LOS for 1999 and 2002 for IRF population, by provider characteristics
Table 5.4: Comparison of LOS, percentage of costs for therapy, and average daily therapy cost for 1999 and 2002, by provider characteristics
Table 5.5: PPS Payment, average case weight, cost and payment to cost ratios for all 2002 cases, by hospital characteristics
Table 5.6: Average standardized cost in 2002 was highly correlated across tier and RIC with case weight and federal payment, but variations in the payment to cost ratio show the need to refine the CMGs and tiers

Chapter I. Background and Executive Summary

The Medicare program began to phase-in the Inpatient Rehabilitation Facility Prospective Payment System (IRF PPS) on January 1, 2002. IRFs are specialized hospitals or hospital units that provide intensive rehabilitation (generally three or more hours a day of therapy) in an inpatient setting. Under the IRF PPS, Medicare pays facilities a predetermined rate per discharge. This rate varies by case mix group: the groups depend on the patient's age, impairment, functional status (motor and cognitive) at admission, and comorbidities. In addition, patients who die in the hospital, short stay transfer patients, atypically short stay patients, and high cost outliers receive special rates. The rate also varies across facilities based on area wages, the share of a facility's patients that are low income, and rural location. Previously, inpatient rehabilitation facilities were paid using a historical cost-based system.

The shift from cost-based to prospective payment gives facilities incentives to provide care efficiently, since they can keep any difference between the prospectively set payment amounts and their costs. However, it also gives facilities incentives to change their care and practice patterns in other ways and to change their coding practices to increase revenue. Changes could take the form of adjustments to the way patients are assessed and their diagnoses and functional status are coded, changes in treatment intensity and length of stay, changes in transfer policies, and changes in admissions policies. In addition, some changes coinciding with the new PPS could be due to other Medicare rules or other changes taking place in the health care system. These changes, no matter what their cause, could have adverse or beneficial effects on patients and/or cause unwarranted increases in Medicare expenditures.

In this chapter we describe changes in incentives due to the implementation of the prospective payment system, and then briefly summarize the work presented in detail in the following chapters on monitoring use of IRF care. Two related project reports describe changes in the use of post-acute care generally and probe whether there are real changes in the severity of patients seen in IRFs (Beeuwkes Buntin et al. 2005; Paddock et al. 2005).

1.1 Payment System Changes

Before looking at the results of monitoring IRFs' responses to the IRF PPS, it is important to understand how the payment system works and particularly the incentives provided by the payment system. The Balanced Budget Act of 1997, as amended by the Balanced Budget Refinement Act of 1999 and the Benefits Improvement Act of 2000 provided for a per discharge PPS. IRFs began to be paid under the prospective payment system on the first day of their fiscal year following January 1, 2002. Thus, some facilities fell under the system immediately, while the payment system was effective for others as late as December 2002. Regardless of fiscal year, however, IRFs were required to submit patient assessment forms beginning on January 1, 2002.

The IRF PPS payment system assigns cases to Case Mix Groups (CMGs) in order to establish payment amounts. The data used to assign CMGs to each IRF patient come from the IRF Patient Assessment Instrument (PAI). In order to assign a CMG, each case is first classified into one of 21 Rehabilitation Impairment Categories (RICs). Most RICs are based on particular body structures and/or causes of impairment.

Each RIC is subdivided into CMGs based on functional independence and age. Functional independence is determined by the response to 17 questions on the IRF PAI. The sum of 12 items is used to create a motor score, and the remaining five items are summed for a cognitive score. The values of motor and cognitive scores and patient age determine the patient's CMG assignment within RIC. The CMG assignment rules were derived in order to maximize the ability to predict cost under the constraint that payment for care of a patient with a lower score (less independence) is never less than for care of an otherwise similar patient with a higher score.

Comorbidities are used to split most CMGs into four payment subgroups: three comorbidity tiers and a subgroup with no relevant comorbidity. Payments are increased by an outlier supplement for very expensive cases. Also, short stay transfer cases are paid on a per diem basis, where the amount of the per diem depends on CMG.

Payment CMGs are calculated during bill processing and depend on the discharge destination shown on the bill, the length of stay, and the admission CMG previously assigned. The payment CMG is the same as the admission CMG for cases with a stay more than three days in the hospital and that are discharged alive. Transfer cases that

stay 3 or fewer days also remain in the admission CMG. Non-transfer cases that stay 3 or fewer days and cases that die in the hospital are assigned to one of 5 special payment CMGs.

One goal of the IRF PPS is to enhance access to IRF care by compensating IRFs based on their case mix. Prior to the IRF PPS, payment for inpatient rehabilitation care for Medicare beneficiaries had been made under the Tax Equity and Fiscal Responsibility Act (TEFRA) of 1982 (as amended by subsequent legislation). TEFRA capped per discharge payments to an inpatient rehabilitation facility at a facility-specific maximum that was determined using the IRF's base year of operation from which facility-specific costs were estimated. Under TEFRA, there was no adjustment to payments due to changes in a hospital's case mix the base year. Updates to the rates did not keep up with inflation, thus allowing new hospitals to obtain larger payments than existing hospitals. The lack of case mix adjustment under TEFRA created incentives for providers to preferentially admit relatively less expensive cases, thus raising concerns that TEFRA limited beneficiary access. The IRF PPS was expected to enhance access by providing greater levels of reimbursement for those with greater clinical needs (Stineman, 2002). Another goal of the IRF PPS is to control Medicare's inpatient rehabilitation expenditures. Cases that did not fulfill an entire course of rehabilitation, such as short stays and transfers, were fully compensated under TEFRA. IRFs took advantage of incentives under TEFRA to maximize payment. This led to increased utilization and cost during the base year(s), as well as afterward, relative to pre-TEFRA years, thus resulting in increased expenditures for the Medicare program (Chan et al., 1997). By 1995, payments exceeded costs by 7 percent in freestanding rehabilitation facilities and 4 percent in rehabilitation units (MedPAC, 1998).

1.2 Provider Responses to PPS

The implementation of prospective payment can trigger a range of effects among providers (Ellis and McGuire, 1996). Providers can succumb to *stinting* on the amount of care delivered, for example by reducing therapy intensity. Providers can engage in *selection behavior*, such as changing their admission policies so as to restrict access for patients not likely to be profitable and increase admission rates for patients who are likely to be profitable. Providers can alter their *coding practices* for patient functional status in

order to increase payments without changing their case mix; this coding could occur in the form of deliberate upcoding or in response to changes in coding instructions, better training of coding staff, and incentives under the new payment system to thoroughly code patients' limitations. On the positive side, providers might respond to prospective payment by becoming more *efficient* and produce equivalent health outcomes with fewer inputs. Providers who experienced fiscal pressure under the former payment system might be able to admit patients who are more *medically complex* or who have lower functional status than before.

Provider responses to prospective payment across a variety of care settings have been documented that highlight the potential for stinting. In a large, nationally representative sample of Medicare beneficiaries from 297 hospitals, Kahn et al. (1992) found that the length of stay (LOS) after implementation of the PPS for acute care hospital inpatient services dropped significantly for all of the conditions studied despite patients being sicker at admission post-PPS versus pre-PPS and that there was greater instability among patients at discharge following implementation of the PPS. Neu and Harrison (1988) found that this observed decrease in the average length of an acute care stay was accompanied by increases in SNF and HHA utilization following an acute care stay, indicating the potential for a shift of care that had been previously provided by the acute care hospital to other settings. The effect of the Balanced Budget Act (BBA) of 1997 on post-acute care has also been examined. Angelelli et al. (2002) found that the lengths of stay and readmission rates of the costliest, most medically complex patients discharged to nursing facilities in Ohio post-BBA versus pre-BBA were quite steady over time, while Yip et al. (2002) found decreases in the intensity and duration of physical and occupational therapies among Medicare beneficiaries in three southern California SNFs. White (2003) similarly concluded that the proportion of patients in freestanding SNFs receiving high levels of therapy declined after the SNF PPS was implemented.

Selection behavior effects have been found as well. In a small sample of Medicare beneficiaries in three southern California SNFs following implementation of the SNF PPS, Yip et al. (2002) found that patients admitted post-PPS had conditions with better-defined (i.e., more predictable) care protocols, though patients had worse scores on health-related quality of life and functional status but better scores on emotional health.

Newhouse (1989) found that acute PPS discharges for which the payment was relatively less generous increasingly were admitted to "last resort" public hospitals under the acute PPS.

Coding change has been identified under prospective payment implementation. One-half of the increase in the case mix index of Medicare patients at acute care hospitals in FYs 1987 and 1988 was attributed to changes in coding and administrative practices, resulting in increased Medicare expenditures (Carter, Newhouse, and Relles, 1991). Coding changes were expected following the IRF PPS since providers did not previously have an incentive to thoroughly code patient comorbidities; comorbidities garner additional payment under the IRF PPS that did not exist under the TEFRA system. The IRF PAI used under the IRF PPS to collect patient admission and discharge information on functional status, was slightly modified from the FIM™ Instrument that was used prior to the IRF PPS, which could also cause coding change.

1.3 Monitoring the IRF PPS

The goals of the IRF PPS and the theoretical and observed effects of prospective payment led to the analyses described in this report. It focuses on two areas: changes in beneficiary access to and use of IRF care and responses to specific incentives created by the payment system. In monitoring access to care it is important to describe trends in the use of IRF care, monitor the types of beneficiaries accessing IRF care, and look for evidence that payment changes affect beneficiary access to IRFs. As mentioned above, the shift from cost-based to prospective payment gives facilities incentives to provide care efficiently, since they can keep any difference between the prospectively set payment amounts and their costs. However, it also gives facilities incentives to selectively treat patients who are expected to have below-average costs within a payment category and to change their coding practices. It was important to monitor, therefore, IRF changes in utilization patterns, responses to special payments for atypical patients, resource use in IRFs, and coding changes. This report also addresses the Congressional mandate for a study of IRF patient access to care.

1.4 IRF Utilization Patterns

Patterns of utilization within IRFs were examined for evidence of changes. Patterns in IRF care observed in the analysis of 2002 data were largely consistent with

the incentives created by the IRF PPS and with trends previously observed from 1996 through 1999. There was an increase in the number of IRFs caring for Medicare patients and a larger increase in the number of Medicare beneficiaries seen in IRFs between 1999 and 2002 in both absolute terms and on a per eligible beneficiary basis. There was also a shift in the composition and/or *coding* of patients seen in IRFs after the implementation of the IRF PPS. A greater proportion of patients were coded as having comorbidities and motor and cognitive functioning scores declined[1]. More details can be found in Chapter 3 of this report.

1.5 Unusual Cases

Specific types of patients with atypical stays were examined to see if prospective payment might shift patients across sites. Under the IRF PPS, typical cases are defined as those that stay more than 3 days, receive a full course of inpatient rehabilitation, and are discharged to the community. Special payment rules apply to most unusual cases that deviate from this pattern. There are anticipated behavioral changes in response to these rules that might occur under the IRF PPS if an IRF tries to maximize net revenue. The incentives are specific to the payment policies for unusual cases and may interact with other incentives to reduce costs and increase revenues. (Precise estimates of changes in transfer rates, and therefore also of atypically short stay cases, are problematic because of inconsistencies in the definitions used to report transfers and the under-reporting of short stay cases in the 1999 baseline data.)

For the most part, IRF facilities responded in anticipated ways to the financial incentives created by the various policies for very short stay cases and interrupted stays.[2] In particular, there is evidence of:

- A reduction in non-transfer stays lasting fewer than 3 days and an increase in non-transfer stays lasting 4-5 days. The proportion of non-transfer cases considered very short stay cases declined about 10 percent.

---

[1] Patients are coded into tiers based on their comorbidities. Tier 1 is the most expensive tier. A greater ability to function independently is captured in higher functioning scores.

[2] A per diem rate applies to a *short-stay transfer*- a patient with a length of stay that is less than the mean length of stay for the CMG minus 0.5 days who is transferred to another IRF, an acute care hospital, a long-term care hospital, or a Medicare or Medicaid-certified nursing home. Long-stay transfers are paid as a typical case. One CMG payment is made for an *interrupted stay*, which occurs when a patient is discharged and returns to the same IRF within 3 consecutive calendar days.

- A reduction in the proportion of interrupted stays lasting fewer than 3 days and an increase in the proportion lasting 4-5 days. A substantial increase in short-stay transfers that was largely offset by a decline in longer stay transfers so that there was only a small increase in the overall transfer rate (1 %). We assume that the increase in short-stay transfer rates largely reflects the overall trend toward shorter stays. There was an increase in the transfer rates to acute care hospitals but a decline in transfer rates to SNFs and nursing homes. With the increase in transfer rates to acute care hospitals, we would have expected to find a parallel increase in interrupted stays that are paid as separate discharges; contrary to expectations, we found that the overall rate of interruptions lasting 10 or fewer days declined, which indicates fewer of these patients return for additional IRF care.

Freestanding hospitals showed stronger behavioral responses than units to the incentives created by the payment policies for very short stays and interrupted stays. These responses, together with other actions to reduce costs and increase revenues, have resulted in lower costs per discharge for freestanding hospitals and higher payment-to-cost ratios for unusual cases. For interrupted stays, the payment-to-cost ratio for freestanding hospitals was 1.07 compared to 0.89 for units of acute care hospitals. Consistent with having lower costs per discharge, freestanding hospitals received 1.2 percent of total payments as outlier payments compared to 4.0 percent for units of acute care hospitals.

Overall, outlier payments were 3.0 percent of total payments, which was the percentage offset used to establish the initial outlier threshold and provides support for retaining the same threshold until more recent data become available. It appears that the behavioral responses to the IRF PPS were sufficient to offset increases in outlier payments attributable to the use of outdated cost-to-charge ratios to estimate costs. All else equal, outlier payments may decline in the future as IRFs continue efforts to reduce costs per case and cost-to-charge ratios reflect more current cost data. More details can be found in Chapter 4 of this report.

1.6 Resource Use

Also mentioned above, providers can respond to prospective payment by becoming more *efficient* and/or by *stinting* on care since they can keep differences between payments and costs as profit. These changes can be manifest in changes in

resource use including changes in IRF length of stay (LOS), costs (including therapy costs), and payment-to-cost ratios.

Length of stay in IRFs has been declining at least since 1998. There was a particularly large decline in the number of cases with extremely long LOS and an increase in the percentage of cases in most payment groups discharged at the average LOS. The rate of decline increased throughout this period and average LOS declined 5.8 percent from 2001 to 2002, the first year of the PPS. Average LOS declined within each RIC between 1999 and 2002, the two years for which case mix data were available. The rate of decline in LOS varied across groups of hospitals. In general, hospitals that had long LOSs in 1999 had greater percentage declines between 1999 and 2002, thus increasing the uniformity of IRF LOS across the country and across types of hospitals.

The average cost per case declined by 0.6 percent between 1999 and 2002. Since LOS declined by a much greater percent, the cost per day increased by 14.1 percent. This exceeds the three-year rate of increase in the hospital market basket of 10.9 percent. Therapy costs per day increased at a lower rate (8.6 percent) than other costs in the same period, thus decreasing the percentage of costs devoted to therapy from 24.4 percent to 23.2 percent.

The rate of change in average case costs, daily costs, and payment-to-cost ratios also varied across groups of hospitals. Unlike LOS, daily costs did not become more uniform across hospital groups or regions. For example, in 1999, freestanding cases cost approximately $200 more than units. By 2002, freestanding cases cost $750 less than units. If all hospitals had been paid based on 100 percent of the PPS rates throughout all of 2002, PPS payments during 2002 would have been 17 percent higher than cost. This is due to the lack of cost growth per case since 1999, the increase in the payment rate by the CMS Actuary to account for payment trends under TEFRA, and changes in coding. Payment- to-cost (PTC) ratios varied across groups of hospitals, with the largest values being for freestanding and proprietary hospitals (1.26 and 1.28 respectively). In contrast, units had a PTC ratio of only 1.11. Despite the fact that freestanding hospitals had much lower costs in 2002 than units, they had longer average LOS. Therefore, it remains possible that the PTC ratio of units was affected in part by accounting practices left over from the TEFRA era; TEFRA cost-based payments were determined through a cost

allocation process and hospitals had an incentive to shift costs from their acute care services, paid under the acute prospective payment system, to the rehabilitation units.

The PTC ratios for other groups of IRFs show the effectiveness of the payment adjustments, with only small variations between rural and urban areas, and by DSH categories. Although payment largely followed costs by RIC and tier, variations in the PTC ratio across these categories show the need to refine the payment parameters of the PPS. There also was a positive correlation between PTC ratio and hospital CMI quartile. In addition to demonstrating that the current weights are inappropriate for the coding practices prevalent in 2002, this may indicate that coding practices varied across hospitals with those in the highest CMI quartile responding most completely to the PPS incentives, or even upcoding. More details can be found in Chapter 5 of this report.

1.7 Limitations

It is important that all of the changes associated with the shift to the IRF PPS be studied in the context of changes in overall patient care use, costs and outcomes. For example, declines in lengths of stay may indicate increases in treatment efficiency if patient outcomes remain steady. Similarly, increases in payments to IRFs could theoretically be offset by decreases in the use of other types of care, such as home health care, following discharge from IRFs. In addition, it should be noted that these analyses reflect the latest data available, but that they only cover the early stages of the IRF PPS implementation. Therefore, it is important to continuously monitor the impact of the implementation of the IRF PPS as additional data, including data on Medicare costs and outcomes, become available.

Chapter II. Data

In the analyses in the following chapters, we examine characteristics of IRF discharges between 1998 and 2002. The 1998 and 1999 data were previously used to develop most parameters of the IRF PPS. The 2002 data are from the first year of the implementation of the PPS. We use bills (or equivalently MEDPAR) for each of the 5 study years. For 1998, 1999, and 2002, we also use additional case mix data. Each of these data sets and the role they play in our analyses are described further below.

2.1 Data Sources

2.1.1 Medicare Bills

The inpatient bills are submitted to the Fiscal Intermediaries by the IRFs. We use the bills after standard analytic file processing. These bills contain provider number, beneficiary number, age, admission date, and discharge date. We calculate length of stay as discharge date minus admission date, using 1 as the minimum LOS.

The bills contain charges for ancillary services, which we aggregate to MEDPAR departmental charges. We then use cost-to-charge ratios and a routine per diem calculated from the cost reports to estimate the cost of each case. We drew hospital cost reports from the public use files dated September 2003. For each discharge we tried to use the cost report that contained the day of discharge. When this was not available (as it was not for 38 percent of the 2002 discharges), we used the cost report that was closest in time to the day of discharge and inflated the per diem payments.

The bills also contain discharge destination, which is used to determine whether the stay ended with a transfer or an in-hospital death. A flag on the bill is used to determine whether the hospital was paid under PPS at the time of the discharge. For cases paid under the PPS, the CMG and comorbidity tier are found on the bill.

The bills for CY 2002 were received in October 2003 and thus our bill file should be essentially complete for all years from 2000 through 2002.

2.1.2 Case Mix Data

For 1998 and 1999 we used case mix data provided by UDSmr and HealthSouth as described in our implementation report (Carter et al; 2002). For 2002 we use the IRF Patient Assessment Instrument (IRF PAI) as the source of case mix data.

IRFs submit each patient's IRF PAI record electronically to the national database using the Inpatient Rehabilitation Validation and Entry System (IRVEN) or vendor purchased software. The receiving system validates the provider's identity and checks certain items on the record for valid codes. In particular, it checks that the submitted CMG and tier are consistent with information on impairment, age, functional status, and comorbidities found on the IRF PAI.[3]

In this analysis we use the IRF PAI impairment group code at admission (item i21a), the list of up to 10 comorbidities in IRF PAI item 24, and the functional independence measures at admission in item 39Aa thru 39Ra. The IRF PAI file that we used was drawn from the national file during November, 2003 and should be complete for discharges in CY 2002.

2.1.3 Matched Bill and Case Mix Data

As described in our implementation report, we attempted to match each 1998 and 1999 MEDPAR record from a participating provider to a case mix record using demographic variables. For 2002, we also matched within provider (after cleaning this field on the IRF PAI), using admission, discharge, transfer, and return dates and the beneficiaries' encrypted identifier. We used patient demographics (age, sex, zip code) only in cases where the identifiers did not match.

For cases paid under PPS, we use only records where the bill CMG is consistent with the IRF PAI CMG.

2.1.4 Facility Specific Payment Adjustments

We estimated payment under the PPS for cases in CY 2002. We used the wage index from the final rule for the first year of the PPS (CMS, 2001). We took the low-income adjustment and urban/rural status from CMS's PRICER for the relevant period -- the FY 02 PRICER for cases discharged before Oct. 1 and the FY 03 PRICER for case in the last calendar quarter. We also used the cost-to-charge ratio on the PRICER to determine outlier payments.

2.1.5 Derived Variables

The Rehabilitation Impairment Category (RIC) is determined from the second and third character on the IRF PAI's CMG. Cases that are atypically short stays (non-transfer

---

[3] We've independently verified that the CMGs on the IRF PAI are essentially always consistent with the underlying data and that, when the bill contains a CMG, the CMG on the IRF PAI *is* practically always consistent with the CMG on the bill.

cases with LOS <= 3 days) and in-hospital deaths are assigned to RIC 50 or 51. Tier is determined from the first character of the same CMG variable, but is not assigned for cases in RICs 50 and 51.

The IRF PPS contains an interrupted stay rule. If a patient is discharged from an IRF and then returns to the same IRF in three days (the day of discharge or either of the following two calendar days), only a single payment will be made for both parts of the stay. Separate bills for each part of interrupted stays were appropriate during the pre-PPS portion of 2002 and earlier. We "bundled" multiple bills for records that would meet the interrupted stay rule of the PPS into a single simulated stay for all admissions from 1998 through 2002. We take admission date for the stay from the first bill in the bundle. We take discharge date and discharge destination for the stay from the last bill in the bundle. We calculate LOS and cost for the bundle as the sum of the LOS and costs for all discharges in the bundle. For cases matched to a case mix record, we use data from the case mix record matched to the earliest bill in the bundle.

In-hospital deaths are defined as those with a discharge destination of 20. For 2002, transfers are defined as cases with discharge destination on the bill in any of 02, 03, 61, 62, 63, or 64.[4] Chapter 4 describes changes over time in the codes used in the discharge destination field and how we deal with these changes.

2.2 Sample Selection and Sample Size

2.2.1 Longitudinal analyses

For the longitudinal sample, we use all bills paid by Medicare with only two exceptions. First, we drop all cases in Maryland because that state is not under the PPS. Second, as described in more detail above, we treat all discharges in an interrupted stay bundle as if they constituted a single discharge. Table 2.1 provides the number of cases in the longitudinal analyses in each year.

2.2.2 Case Mix Data

For the analyses of case mix data, we are restricted to cases with matched case mix data and bill data for 1998, 1999, and 2002. Our bill records show that 473,645 bills for inpatient care of Medicare patients were submitted from IRFs during CY 2002.[5] As shown in Table 2.2, we eliminated 1,661 records that would not be paid under the PPS

[4] The discharge codes are described in Chapter 4.
[5] This number excludes two duplicate bills and 49 bills that overlapped another bill.

because they were part of interrupted stays. This produces the same 471,984 cases shown as bundles in Table 2.1.

We matched 436,822 of the remaining bills to an IRF PAI record where the IRF PAI data was consistent and the bill data was consistent with the IRF PAI (92.5 percent of cases) resulting in the 436,822 records that are used for most analyses. Some analyses eliminate in-hospital deaths and atypical short stays.

In Chapter 5 we analyze the estimated cost of the 2002 cases. As shown in the bottom section of Table 2.2, we are missing cost data for 11,315 of the bundled cases (2.4 percent). For analyses that use both case mix data and cost, we can use only 426,622 cases. To simulate PPS payments, the 2002 cases also needed to have covered charges that were greater than zero.

For 1998 and 1999, we use the final analysis sample described in our implementation report, Carter et al. (2002). In that paper we note that units are under-represented in the matched sample and freestanding hospitals are over-represented. Table 2.3 shows, separately for units and freestanding hospitals, the number of bundles in the population of IRF discharges in 1999 and in our case mix sample. We have only 55 percent of unit cases, but 83 percent of freestanding cases.

Here we wish to describe how care patterns changed between 1999 and 2002 and we do not wish our findings to be confounded by the unrepresentativeness of our sample given that there are certain aspects of case mix and resource use that are strongly correlated with being a unit. In order to accurately describe changes in these aspects of IRF care, we use several strategies. When possible, we use the bill data which contains all cases. Often we present case mix data separately for units and freestanding hospitals. Finally, we sometimes use weights as if we had a sample with 2 strata -- units and freestanding. Although we do not have a random sample, in cases where we can check accuracy (e.g. LOS), we find that the weighted estimates of population parameters are more accurate than the unweighted estimates. The sample weights used in these analyses are shown in the last column of Table 2.3.

Chapter III: Overall Utilization Patterns

Patterns observed in our analysis of the 2002 IRF data are consistent with the incentives created by the IRF PPS and with trends previously observed from 1996 through 1999. There was an increase in the number of IRFs caring for Medicare patients and a large increase the number of Medicare beneficiaries seen in IRFs between 1999 and 2002. There was also a shift in the composition of patients seen in IRFs after the implementation of the IRF PPS. A greater proportion of patients were coded as having comorbidities and motor and cognitive functioning scores declined. The case mix index (CMI) increased by approximately 4 percent between 1999 and 2002.

3.1 Overview

In this chapter we describe findings about changes in care patterns and patient classification under the IRF PPS. We used the data from patient assessments and bills described in Chapter 2 to examine patterns in the use of IRF care before and after the implementation of the new payment system. Specifically, we examined trends in length of stay, case mix group assignments, and comorbidities. We also looked at trends in the factors that are used to assign case mix groups, namely patients' impairments and FIM™ motor and cognitive scores. In addition, we assessed the overall case mix of IRF patients in 1999, before the new payment system was implemented, and in 2002 when facilities were being introduced to the new system.

3.2 Methods

We compared the number and composition of discharges in the years prior to the IRF PPS to those in 2002. We examined the trends in these data over time, mostly in terms of percentage increases and decreases. We also looked at trends in data submitted by hospitals under the PPS in 2002, and trends in data submitted by hospitals not yet paid under the PPS.

As described in Chapter 2, our 1996 through 1999 data cover only a sample of facilities. A comparison of the sample with the population showed that the sample was biased in two ways. First it over represented freestanding hospitals and it under-represented very short stays (Carter et al., 2002). To avoid confusing changes in the sample with real changes in the cases cared for in IRFs we repeated many analyses

separately for freestanding hospitals and for units. In addition, we calculated the overall case mix index for IRF patients seen in 2002 and compared it to the case mix index in 1999. A case mix index is the average of the case weights assigned to some specified set of patients (cases). The case weights are relative weights -- i.e. they provide expected cost of each CMG relative to other CMGs. In the IRF PPS the weights were calculated from the matched data set for 1999. They were normalized so that each weight gives the cost of a case in the CMG relative to the average case in the data set. In calculating the CMI, short stay transfer cases are counted as only a fraction of a case. Thus, our 1999 national CMI was 1.0 when short stay cases are counted as only a fraction of a case. The methods and formulas used to calculate the CMI are described in Appendix 1.

3.3 Results

Overall, changes observed in the data were consistent with IRF PPS incentives and/or with ongoing trends in IRF care. There was a slight increase in the number of IRFs caring for Medicare patients and a larger increase in the number of Medicare beneficiaries seen in IRFs over the period examined. There was also a shift in the composition of patients seen in IRFs. After the implementation of the IRF PPS a greater number of patients were coded as having comorbidities and as having poor motor and cognitive functioning. The overall CMI increased by approximately 4 percent. Each of these changes is described in greater detail below.

3.3.1 Volume. Table 3.1 shows the increase in the number of IRFs serving Medicare patients and in the number of Medicare discharges from IRFs over the period 1996 through 2002. The number of IRFs grew by 11.5 percent over this period, while the number of bundled discharges grew by 39 percent. The annual growth rate in the number of patients served between 1999 and 2002 is slightly larger than that seen in earlier years. The number of bundled discharges per 100,000 fee-for-service (FFS) enrollees increased in each year from 1996 to 2002, with the rate of increase lowest in 2001 and 2002.

3.3.2 Composition. Figure 3.1 shows the distribution of IRF patients across rehabilitation impairment categories (RICs) in 1999 and 2002. Atypical short stays and in-hospital deaths are excluded from this composition analyses. The proportion of cases in RIC 1, the stroke RIC, decreased markedly while the proportion in RIC 8, the lower extremity joint replacement RIC, and RIC 14, the cardiac RIC, increased. Table 3.2 shows that

these patterns held for both freestanding and unit facilities. Table 3.2 also shows that this shift was generally more pronounced for cases paid under the IRF PPS. Some of these RICs, specifically 18 (major multiple traumas with brain or spinal cord injury), 19 (Guillian Barre), and 21 (burns), are very small. Thus, changes in these RICs should be interpreted with caution.

Figures 3.2 and 3.3 show that there was a strong shift towards lower motor and cognitive scores across RICs between 1999 and 2002. The mean motor score decreased from 42.8 to 40.2 between 1999 and 2002 and mean motor scores decreased in every RIC. Mean cognitive scores decreased in every RIC except for RIC 2, traumatic brain injury. Interestingly, however, the decreases in the cognitive scores occurred across all RICs except for RIC 2 for which the mean cognitive score held steady, rather than increasing in only RICs for which cognitive functioning affects payment.[6] Table 3.3 shows that the overall decline in motor and cognitive score: the decreases in motor and cognitive scores were less pronounced in units.

These decreases in motor and cognitive scores affected the proportion of patients grouped into each CMG in all RICs. Figure 3.4 graphically illustrates the shift within the stroke RIC from lower-weighted CMGs on the left-hand side of the chart to higher-weighted CMGs on the right-hand side of the chart.

In addition to lower motor and cognitive scores, more patients were coded as having comorbidities that qualified them for higher tier payments. Table 3.4 shows that the proportion of patients in each of the 3 tiers increased, and it increased in most combinations of RIC and tier. The proportion of patients not classified into a comorbidity tier fell from 81 percent in 1999 to 75 percent in 2002. Figure 3.5 shows that the increase in the proportion of patients in comorbidity tiers was most pronounced in freestanding hospitals. This pattern was expected, since we thought that units would have better coding practices in the pre-PPS period. Thus, a significant portion of this increase in tier assignments may be due to better coding and adherence to Medicare rules.

3.3.3 Case Mix. Table 3.5 shows the net results of these changes in the composition of patients seen in IRFs and in length of stay. For the sample of hospitals that were in both our 1999 and 2002 matched data sets the CMI increased more – 5.8 percent.

[6] The RICs in which FIM cognitive score is a factor in payment are: 1, 2, 5, 8, 12, and 18.

In addition, in analyzing the non-sample data from 1999, we found that case mix was actually lower than in the sample, predominantly because many cases with LOS of 3 days or less were not sent to our FIM databases, but also because the sample underestimates units and these have a lower case mix. In the formula that was used to set the payment rate, therefore, the rate was increased by 1.0 percent to account for the non-representativeness of our sample. This is approximately equivalent to a 1 percent reduction in case mix or a true national CMI for 1999 of 1.00.[7]

3.3.4 Demographics. Table 3.6 shows the percent of cases by demographic category for the bundled discharges having FIM™ scores in 1999 and 2002. There is a slightly greater prevalence of older cases in 1999 versus 2002. There are decreases in each age category above 80 years of age in 2002. In contrast, the median age of Medicare enrollees held almost steady between 1999 and 2002, with a median age of 74.6 years in 1999 and 74.7 in 2002[8]. The distribution of cases by race category shows an increase in the number of non-white cases (86.7 percent in 1999 versus 84.6 percent in 2002), which is a percentage point larger than the increase in non-white cases among all Medicare beneficiaries during that time.[9] The percent of married and female cases remains steady through time.

3.4 Conclusions

While these trends are generally consistent with expectations about IRF responses to the new payment system, they reflect a combination of factors. These factors include changes in coding, real changes in case mix, and other changes in incentives produced by the IRF PPS.

Coding may have changed under the PPS for a number of reasons mentioned above. First, the new IRF PAI manual changed the coding rules for some items, and clarified the rules for some impairment codes and FIM items. Second, facilities might have increased their adherence to coding rules and improved the accuracy of their coding.

---

[7] We did not estimate the adjusted national case mix index, because it is the weighted average with short stay transfers counted as only a fraction of a case. To know the fraction of short-stay transfers we would have needed to predict the CMG that non-sample patients would fall into. However, we did not feel we could accurately predict CMG without any information on functional status.

[8] http://www.cms.hhs.gov/researchers/pubs/datacompendium/2003/03pg3132.pdf

[9] http://www.cms.hhs.gov/MCBS/CMSsrc/1999/Summary1.pdf and http://www.cms.hhs.gov/MCBS/CMSsrc/2002/Section1.pdf.

This is particularly true for comorbidities. Third, some portion of the coding change is likely due to "upcoding" in order to maximize revenue.

In addition, the shift in the composition of patients that we saw may reflect a real change in patient case mix. This could be due to changes in the broader health care system, including discharge practices from acute care and the shift to a greater emphasis on post-acute and outpatient care. In fact, there has been a decrease in the number of stroke cases in the acute care population over time accompanied by an increase in the number of joint replacement cases, which corresponds to the shifts seen within rehabilitation cases during the same time window (Beeuwkes Buntin et al., 2005). It could also reflect technological or practice changes in rehabilitation. Finally, it could reflect the fact that some IRFs had been constrained by a low base cost under the previous TEFRA system and can now afford to admit more complex patients. Further work disentangling the effects of coding from real case mix change will be forthcoming in another report.

Chapter IV. Unusual Cases

Under the IRF PPS, typical cases are defined as those that stay more than 3 days, receive a full course of inpatient rehabilitation, and are discharged to the community.[10] Special payment rules apply to unusual cases and there is a fear that these special rules may cause providers to shift patients between settings or change practice patterns to maximize payments. These payment rules are:

- *Very short-stay discharges* are all non-transfer discharges within 3 or fewer days of admission, including discharges of patients who died in the hospital within 3 days of admission. These discharges are assigned to a special CMG.[11]
- *Short-stay transfers* are patients with a length of stay that is no more than the mean length of stay for the CMG minus 0.5 days, and are transferred to another IRF, an acute care hospital, a long-term care hospital, or a nursing home that is certified by Medicare and/or Medicaid. A per diem payment applies to these discharges. It is based on the CMG payment for a typical case divided by the average length of stay for patients assigned to the CMG. Total payment equals the per diem payment multiplied by the number of days the patient was in the facility plus an additional half-day per diem payment. Long-stay transfers are paid as a typical case.
- *Interrupted stays* occur when patients are discharged and return to the same IRF within 3 consecutive calendar days. One CMG payment is made for these stays based on the assessment from the initial admission. The duration of the interrupted stay begins with the day of discharge from the IRF and ends on midnight of the third day. No DRG payment is made to the acute care hospital when the beneficiary is discharged and returns to the same IRF on the same day.
- *High cost outliers* receive additional payments. The additional payment equals 80 percent of the difference between the estimated cost for the case and the CMG payment plus an outlier threshold. Estimated cost is determined by applying a cost-to-charge ratio to the charges on the bill.

The chart below summarizes the incentives created by the payment policies for unusual cases. These are anticipated behavioral changes that might occur under the IRF PPS if the IRF tries to maximize net revenues. The incentives are specific to the payment policies for unusual cases and may interact with other incentives to reduce costs and increase revenues.

---

[10] Medicare counts an inpatient day if a beneficiary is in the hospital at midnight. The day of admission is counted but the day of discharge is not counted unless the admission and discharge day are the same day. If a patient is admitted with the expectation that the patient will remain overnight, but is discharged or dies before midnight, the day is counted.

[11] Patients who expired in the hospital after 3 days are assigned to four other special CMGs based on their length of stay relative to other patients who expired and whether the case is assigned to an orthopedic RIC.

Summary of IRF PPS Payment Incentives for Unusual Cases

Special Payment Rule	IRF PPS Incentives
Very short-stay discharges	Reduce stays of 3 or fewer days and increase stays of 4 or more days in order to receive full CMG payment.
Short-stay transfers	Reduce relative proportion of short-stay transfers and increase relative proportion of long-stay transfers in order to receive full CMG payment; increase transfers to nursing homes in order to discharge the patient more rapidly and to acute care hospitals to shift costs.
Interrupted stays	Increase interrupted stays lasting 1 or more days as a means of shifting costs to acute care hospitals; reduce relative proportion of 0-3 day interruptions in order to receive two CMG payments instead of a single bundled payment.
High cost outliers	Increase charges relative to costs in order to increase estimated costs of case.

Our analysis of 2002 cases found that IRF facilities responded in anticipated ways to the financial incentives created by the policies for very short stays and for interrupted stays.

- There was a reduction in non-transfer stays lasting fewer than 3 days and an increase in non-transfer stays lasting 4-5 days (Section 4.2).
- There was a reduction in the proportion of interrupted stays lasting fewer than 3 days and an increase in the proportion lasting 4-5 days (Section 4.3).

However, there was an unanticipated increase in short-stay transfer rates and a decline in long-stay transfers that are paid as typical cases. While transfer rates to acute care hospitals increased, there was a decline in transfers to SNFs (Section 4.4).

Outlier payments were 3.0 percent of total payments, which is the percentage used to establish the initial outlier threshold (Section 4.5).

In the remainder of this chapter, we discuss the financial incentives created by the policies for unusual cases and the results of our analyses in greater detail. We conclude with discussion of our findings and conclusions (Section 4.6).

4.1 Very Short-stay Discharges

As defined above, very short-stay discharges are defined as all non-transfer discharges within 3 or fewer days of admission, including discharges of patients who expired in the hospital within 3 days of admission. These discharges are assigned to a unique CMG (CMG 5001) with a relative weight of 0.1651 and no comorbidity tiers. Under the IRF PPS, hospitals have an incentive to decrease the number of discharges within this category and increase the number of discharges with LOS of 4 or 5 days. In doing so, they will receive a substantially higher full CMG payment for a shorter than average length of stay.

To monitor the behavioral changes associated with very short-stay discharges, we examined non-transfer discharges involving 3 or fewer days for 1999 through 2002 that would have been assigned to CMG 5001 under the IRF PPS. Since FIM data are unnecessary to classify patients into CMG 5001, we used all bundled discharges in the analysis. We focused only on patients who were discharged alive and did not include those who died within 3 days of admission to the IRF.[12] We found that the proportion of very short-stay discharges was relatively stable in the years 1999-2001 but declined about 18 percent in 2002 (Table 4.1). In 1999, 2.6 percent of patients discharged alive would have been assigned to CMG 5001 compared to 2.2 percent in 2002. The decline is evident for stays lasting 1 or 2 or 3 days and is not limited to only those lasting 3 days. Improvement in reporting of transfers may bias our results. As discussed below, there was improvement in the reporting of transfers under the IRF-PPS, so that transfer cases in the pre-PPS period are under-reported relative to the post-PPS period. This would mean that there might be an overstatement of CMG 5001 cases in the pre-PPS period and an overstatement in 2002 and that the decline in CMG 5001 cases may be overestimated.

4.2 Interrupted Stays

4.2.1 Interrupted Stay Policy and Incentives

The IRF PPS defines an interrupted stay as a stay in which the beneficiary is discharged and returns to the same IRF within 3 consecutive calendar days. The duration of the interrupted stay begins with the day of discharge from the IRF and ends on

[12] Less than 0.1 percent of patients die within 3 days of admission.

midnight of the third day. Thus, if the beneficiary is away from the IRF 2 nights or less, the interrupted stay payment rules apply and one CMG payment is made for both portions of the stay. If the interruption involves a same day admission and discharge from an acute care hospital, no DRG payment is made to the acute care hospital and the IRF is expected to assume the costs of the same-day acute care services. However, a DRG payment is made if the beneficiary remains overnight at the acute care hospital.

Under the TEFRA system, an IRF, particularly if it was under financial pressure from its TEFRA limit, had an incentive to discharge and re-admit a patient in order to reduce IRF costs and receive "credit" for two discharges. The incentives under the IRF PPS are similar but contain two added incentives: to shift interruptions involving acute care services from same day to overnight stays so that the costs of the services are shifted from the IRF to the acute care hospital and to increase the proportion of interruptions involving at 3 or more nights away from the IRF so that two separate payments will be made for each portion of the stay. Monitoring trends in the same day policies is problematic since pre-PPS policies were not clear regarding how a same day admission and discharge from acute care services should have been billed.

4.2.2 Methods

To obtain an understanding of the trends that have occurred under IRF PPS, we compared the distribution of 0-10 day interruptions in the 1999-2002 bill data (Table 4.2). For the 1999-2001 stays, we used only the IRF bills to identify interruptions. That is, we counted a bundle each time there was an IRF discharge and readmission to the same facility within 10 days. We found that identifying interruptions in the 2002 data was somewhat problematic and indicative of potential billing problems for theses cases. In theory, interruptions that are bundled under the IRF PPS interrupted stay policy should be identifiable only in the IRF PAI since a single bill should be submitted that covers both portions of the stay. However, we also found multiple IRF bills that indicated an interrupted stay that either did not match an IRF PAI or was not reported as an interrupted stay on the IRF PAI. We have included in our counts for 2002 all interruptions that were either reported on the IRF PAI or indicated by multiple bills, regardless of what was reported on the IRF PAI. The discharge counts are independent of the IRF PPS bundling rules, so that those cases with 0-2 nights away as well as other

interruptions are counted as two discharges in the table. Only the first discharge and readmission are shown for cases involving multiple interruptions.

4.2.3 Volume Trends

Overall, there has been a slight downward trend in the proportion of discharges involving 1-10 nights away from the IRF and readmission to the same facility, from 6.5 percent in 1999 to 5.8 percent in 2002. The distribution of the interruptions has shifted consistent with the PPS bundling incentives. The proportion of interruptions involving two or fewer nights has been cut in half, declining from about 26 percent of all 0-10 night interruptions in the pre-PPS years to about 12 percent in 2002. The anticipated shift between same day and one-night interruptions is not evident; the proportion of same day, one night and two night interruptions all declined.

We looked at the distribution of interruptions by type of provider to determine if there are differences in interrupted stays by key provider characteristics (Table 4.3). Freestanding hospitals have a higher percentage of interrupted stays lasting up to 10 days (6.7 percent) than rehabilitation units of acute care hospitals (5.5 percent). However, freestanding rehabilitation hospitals have relatively fewer interruptions lasting less than three nights. Interruptions lasting less than three nights comprised 6.8 percent of the interruptions in freestanding hospitals compared to 13.6 percent in units.

Rural hospitals have relatively fewer interruptions (5.0 percent) than urban hospitals (6.0 percent), and a higher proportion of these interruptions are for less than three nights. The pattern of interrupted stays also varies by type of ownership. Proprietary hospitals have a somewhat higher proportion of interruptions than non-profits (6.2 percent vs. 5. 8 percent) but a smaller proportion of these last less than 3 nights (6.8 percent vs. 13.6 percent).

4.2.4 Cost Trends

RAND's implementation report estimated payment-to-cost ratios for interrupted stays under the bundling policies using sample 1998/1999 claims with all the data necessary for simulation (Carter et al., 2002). The simulation suggested that the bundling policy would underpay cases with interruptions lasting less than three nights by about 30 percent. To evaluate how the bundled discharges have actually fared under IRF PPS, we simulated payment-to-cost ratios for the 2002 bundled discharges for which we had the

IRF PAI data needed to determine payment. We show in Table 4.4 the number of bundles, length of stay for rehabilitation (that includes both portions of the stay), and the estimated payment-to-cost ratio assuming all stays had been paid under IRF PPS federal rates in 2002. The simulation indicates the expected underpayment has not materialized. On average, the payment-to-cost ratio for cases receiving a bundled payment is 0.93, considerably higher than the 0.70 projected using the 1998/1999 sample data. Nevertheless, there are differences within hospital classes. Despite longer lengths of stay, bundled discharges are on average profitable in freestanding hospitals (1.07) and proprietary hospitals (1.10) but unprofitable on average in units (.89), non-profit (.87), and government (.95) facilities.

4.3 Short-stay Transfers

4.3.1 Transfer Policy and Incentives

Short-stay transfers are patients who are transferred to another IRF, an acute care hospital, a long-term care hospital, or a nursing home that is certified by the Medicare and/or Medicaid program with an IRF LOS that is less than the mean length of stay for the CMG. Total payment for the stay equals the per diem payment multiplied by the number of days the patient was in the facility plus an additional half-day per diem payment, not to exceed the CMG payment for a typical case.

The transfer policy is intended to apply to patients who did not complete the full course of rehabilitation, to match payment with the resources required for the stay, and to reduce the incentive for premature discharge. The per diem payment for short-stay transfers is based on the average cost of care. Assuming the marginal cost of a day of care is less than the average cost as the case approaches the average LOS for the CMG, IRFs have an incentive to reduce short-stay transfers and increase long-stay transfers, i.e., those with a LOS greater than or equal to the average LOS for the CMG. We would expect to see a relative decrease in the proportion of transfers after only a few days and an increase in the proportion of transfers with a LOS near the mean LOS for the CMG. The per discharge payment applicable to long-stay transfers is likely to create an incentive to increase the number of long-stay transfers to both SNFs and acute care hospitals. The higher SNF transfer rate will occur because the IRF has an incentive to discharge patients as soon as they no longer benefit from a hospital-level rehabilitation

program; some of these patients will not be ready for discharge to the community and will be transferred to a Medicare or Medicaid-certified facility. Similarly, we would also expect the acute care transfer rate to increase since IRFs will have an incentive to transfer patients who have acute care needs, particularly if the acute need is likely to persist more than 3 days.

4.3.2 Methods

Our trend analysis of short-stay transfers is limited to the sample of hospitals with FIM™ data. Comparisons of transfer rates using the IRF bills are problematic for two reasons. First, transfers were under-reported in 1999, when the discharge destination had no effect on payment. As might be expected, when we compared the 2002 transfer rates determined from the IRF bills with those that are identified using Medicare bills (from other settings) and MDS records for nursing home stays, we found some improvement in the coding between 1999 and 2002, which would affect our comparisons. However, the IRF bills still reflected lower short-stay transfer rates than the Medicare bills and MDS data (15.10% vs.15.93%). Second, transfer rates may be overstated for the pre-PPS years relative to the post-PPS years because the IRF bills for the pre-PPS years do not differentiate between transfers to another rehabilitation facility or long-term hospital and discharges to other institutions such as non-Medicare certified facilities that are not defined as transfers under the IRF PPS. To address the under-reporting and comparability issues, we defined a case as a transfer if there was a post-IRF Medicare bill for the beneficiary in which the stay starts on the day of IRF discharge or if there is an MDS record indicating the beneficiary was in a nursing home on the day of IRF discharge.

4.3.3 Findings

Taking the post-IRF Medicare data as our best measure of actual change in transfer cases, Table 4.5 shows that short-stay transfers increased by 16.56 percent between 1999 and 2002.

When we look at all transfers, regardless of whether they are short-stay, we find that the overall transfer rate to acute care hospitals increased from 7.5 percent to 8.7 percent between 1999 and 2002 (Table 4.6). The percentage of transfers to SNFs and nursing homes (NH) declined 7.7 percent from 13.2 percent to 12.2 percent of bundled discharges.

4.4 High Cost Outliers

4.4.1 Outlier Policy

The IRF PPS protects hospitals from substantial financial losses on atypically expensive discharges through a high cost outlier policy. A case qualifies for an outlier payment equal to 80 percent of its estimated cost in excess of the standard IRF PPS payment plus an outlier threshold. That is, the following formula is used for payment:

Outlier payment$_i$ = .80 x (Estimated cost$_i$ – (IRF PPS std. payment$_i$ + outlier threshold)).

The FY2002-FY2004 standardized outlier payment threshold is $11,211.[13] It is adjusted for each IRF to account for the facility's wage adjustment, DSH adjustment, and if applicable, rural adjustment. In determining whether a case qualifies for a cost outlier payment, the estimated costs of the stay are determined by applying an overall Medicare facility-specific cost-to-charge ratio to the billed charges.

The cost outlier policy adopted in the IRF PPS final rule provided estimated outlier payments equal to 3 percent of total estimated IRF PPS payments. One question is whether actual outlier payments under the IRF PPS are substantially different from 3 percent of total payments. There are two potentially offsetting factors that might affect outlier payments. First, behavioral changes associated with implementation of the IRF-PPS are likely to reduce outlier payments. Coding improvements leading to case mix increases would result in higher standard payments, and lower lengths of stay and elimination of unnecessary services would reduce costs per case. Second, the use of the cost-to-charge ratio to estimate costs assumes that charges increase in relation to costs. Industry-wide, hospital charges have been increasing more rapidly than costs and some hospitals have had excessive charge increases. The PRICER used to pay for Medicare stays under the IRF PPS in 2002 used a cost-to-charge ratio from the facility's most recently settled cost report - which may have been several years old. Applying an outdated cost-to-charge ratio to current billed charges overestimates the costs of an inpatient stay and produces higher outlier payments.

---

[13] 66 FR (August 7, 2001), 41362.

4.4.2 Methods

To determine actual 2002 IRF PPS outlier payments, we simulated IRF PPS payments using the cost-to-charge ratios and other payment parameters in the public use PRICER for FY02 (discharges occurring 1/1/02-9/30/03) and FY03 (discharges occurring 10/1/03-12/31/03). Since actual outlier payments are sensitive to a number of factors, we examined the percentage of total payments attributable to outlier payments using only the sample hospitals used to set the FY2002 threshold, only those discharges that were actually paid under the IRF PPS taking into account the federal/hospital-specific blend, and all 2002 discharges. In the latter simulation, we assumed all discharges were paid 100 percent of the federal rate throughout 2002. In all simulations, the outlier percentage was very close to 3 percent of total IRF PPS payments; therefore, we present only the results for the simulation assuming all 2002 discharges were paid 100 percent of the federal rate in Table 4.7.

4.4.3 Findings

There were 415,169 cases in 2002 for which we have the IRF PAI and PRICER information needed to simulate payment under the IRF PPS. We bundled the bills for pre-PPS discharges involving interrupted stays for fewer than three nights, and we applied the payment parameters in the FY02 PRICER if available; if the facility was not paid under the IRF PPS until FY03, we used the payment parameters from the FY03 PRICER.[14] Of the 2002 discharges in our simulation, we estimate 5.0 percent (n = 20,672) would have qualified for additional payment as a high cost outlier. The average payment per outlier

[14] Both PRICER programs were released as part of the rulemaking process and would have been updated by the Medicare intermediaries as needed throughout the year. During FY02 and FY03, intermediaries were required to use the most recently settled cost report and to update the cost-to-charge ratio each time a cost report settlement was made. Thus, a different cost-to-charge ratio may have been used to actually determine the estimated costs for a case than is reported in the public use PRICER. We found some highly aberrant cost-to-charge ratios (plus or minus 3 std deviations from the geometric mean cost-to-charge ratio) that we assume the intermediary would have detected and corrected. We included the cases for these facilities but substituted the more recent PRICER cost-to-charge ratio when available and the mean cost-to-charge ratio for urban or rural hospitals, as applicable, where it was not. Because of the abuses with escalating charges under the PPS for acute care hospitals (IPPS), effective in FY04 intermediaries are to update the cost-to-charge ratio based on the latest final settled or tentatively settled (after desk review) cost report. For other analyses in our study, we calculated cost per case using departmental cost-to-charge ratios from the most recently available cost report. We found that the costs per case estimated using the PRICER cost-to-charge ratios were on average 12.6 percent higher than the costs-per-case using the more recent departmental cost data.

case was $7,503 and aggregate outlier payments were 3.0 percent of total payments. The outlier percentages for urban and rural facilities were 3.1 percent and 1.6 percent, respectively. There were considerable regional differences in the outlier percentages, ranging from 6.8 percent of total payments in the Pacific region to 1.4 percent in the New England region. Outlier payments represented 1.2 percent of total payments to freestanding facilities compared to 4.0 percent to rehabilitation units.

We summarize outlier payments by RIC and comorbidity tier in Table 4.8. Outlier payments represented more than 5 percent of total payments in five RICs: RIC 4 (Traumatic Spinal Cord Injury), 7.0 percent; RIC 11 (Amputation, Other), 5.3 percent; RIC 18 (Major Multiple Trauma, No Spinal or Brain Injury), 5.2 percent, RIC 19 (Major Multiple Trauma With Spinal or Brain Injury), 5.1% and RIC 21 (Burns), 24.3 percent. The outlier percentages increased across the comorbidity tiers. The outlier percentage was 2.5 percent for discharges with no comorbidities compared to 6.0 percent for discharges with Tier 1 comorbidities.

4.5 Discussion and Conclusions

For the most part, IRF facilities have responded in anticipated ways to the financial incentives created by the policies for very short stay cases and interrupted stays. In particular, they have responded with:

- A reduction in non-transfer stays lasting fewer than 3 days and an increase in non-transfer stays lasting 4-5 days. The proportion of non-transfer cases considered very short stay cases declined about 18 percent.
- A reduction in the proportion of interrupted stays lasting fewer than 3 days and an increase in the proportion lasting 4-5 days.

However, there was an unexpected increase of 16.56 % in short-stay transfers between 1999 and 2002 and a 29.44 % decline in longer stay transfers so that there was only a small increase in the overall transfer rate (1 %). The increase in short-stay transfer rates relative to longer stay transfers largely results from coding changes. Cases are being coded into CMGs with a longer average length of stay than their 1999 CMG so that cases that were long-stay transfers in 1999 are short-stay transfers in 2002. The 16 percent increase in transfers to acute care hospitals is not unexpected. However, with the increase in transfer rates to acute care hospitals, we would have expected to find a parallel increase in interrupted stays that are paid as separate discharges; contrary to expectations,

we found that the overall rate of interruptions lasting 10 or fewer days declined, which indicates fewer of these patients return for additional IRF care. Additional analysis of what happens to patients who are transferred back to acute care hospitals - both with respect to their acute care services and where they receive care after their second post-acute discharge - is needed to understand the implications of the increase in the acute care transfer rates.

Freestanding hospitals showed stronger behavioral responses than units to the incentives created by the payment policies for very short stays and interrupted stays. As will be explained in greater detail in the next chapter, these responses, together with other actions to reduce costs and increase revenues, have resulted in lower costs per discharge for freestanding hospitals and higher payment-to-cost ratios. For interrupted stays, which our implementation report suggested would be underpaid about 30 percent, the payment-to-cost ratio for freestanding hospitals was 1.07 compared to .89 for units of acute care hospitals. Consistent with having lower costs per discharge, freestanding hospitals received 1.2 percent of total payments as outlier payments compared to 4.0 percent for units of acute care hospitals.

Overall, outlier payments were 3.0 percent of total payments, which is the percentage used to establish the initial outlier threshold and provides support for retaining the same threshold until more recent data become available. It appears that the behavioral responses to the IRF PPS were sufficient to offset increases in outlier payments attributable to the using outdated cost-to-charge ratios to estimate costs. All other things being equal, outlier payments may decline in the future as IRFs continue efforts to reduce costs per case and cost-to-charge ratios reflect more current cost data.

Chapter V. Resource Use

In this Chapter we examine the resources used to care for IRF cases between 1998 and 2002. We begin by describing changes in length of stay (LOS) in the population and in the sample with case mix data. We then describe changes in resource use, including LOS, the cost of care and the cost of therapy, for groups of hospitals. We conclude by examining payment-to-cost (PTC) ratios for groups of hospitals during 2002.

Length of stay in IRFs has been declining at least since 1998. There was a particularly large decline in the number of cases with extremely long LOS and an increase in the percentage of cases in most payment groups discharged at the ALOS. Average LOS declined within each RIC between 1999 and 2002, the two years for which we have case mix data. The rate of decline in LOS varied across groups of hospitals. In general, hospitals that had longer LOS in 1999 had greater percentage declines between 1999 and 2002, thus increasing the uniformity of IRF LOS across the country and across types of hospitals.

The average cost per case declined by 0.6 percent between 1999 and 2002. Since LOS declined by a much greater percent, the cost per day increased by 14.1 percent. Therapy costs increased 8.6 percent per day in the same period, thus decreasing the percentage of costs devoted to therapy from 24.4 percent to 23.2 percent. We found that if all hospitals were 100 percent on the PPS throughout all of 2002, PPS payments during 2002 would have been 17 percent higher than cost. The rate of change in average case costs, PTC, daily costs, and PTC ratios also varied across groups of hospitals.

The PTC ratios show the effectiveness of the payment adjustments, with only small variations between rural and urban areas, and by DSH categories. Although payment largely followed costs by RIC and tier, variations in the PTC ratio across these categories show the need to refine the payment parameters of the PPS.

5.1 Distribution of Length of Stay of IRF cases

5.1.1 Trends over time

Table 5.1 shows average LOS in the IRF population in each year. Average LOS has been declining steadily throughout the period, but the rate of decline accelerated after 2000, particularly in freestanding IRFs. The total decline in average LOS from 1999 to 2002 was 1.9 days or 12.8 percent. The decline was greater in freestanding IRFs -- 2.8

days or 15.8 percent. The last line in the table shows that the average LOS of 2002 cases on the PPS was quite similar to that for all 2002 cases.

Figure 5.1 gives the cumulative distribution of LOS in the IRF population in each year from 1998 through 2002. The horizontal axis is number of days and the vertical axis is the percent of the year's cases. For the 2002 line, the point corresponding to day x gives the percent of 2002 cases that had an LOS less than or equal to x. For example, almost 90 percent of 2002 cases had a LOS of 22 days or less. The other year's lines have a similar interpretation.

One can see from Figure 5.1 that LOS has been declining steadily in all ranges of LOS throughout this period. If we pick any LOS greater than 7, we can clearly see the lines are ascending: each year's point is higher than the previous year's point so each year there are a higher percent of cases with LOS at least that small.

There was a relatively large decline in the number of cases with long LOS. For example, in 1998, 24 percent of cases had LOS longer than 20 days, but by 2002 only 15 percent of cases had an LOS of more than 20 days. The decline in long LOS cases accelerated in 2000 and was greater between 2000 and 2002 than between 1998 and 2000.

5.1.2 Changes in LOS within RIC

We saw in Chapter 3 that the distribution of RICs changed between 2002 and 1999. Since the RIC that increased the most has a shorter than average LOS, it is worthwhile to examine whether declines in LOS occurred within RIC as well as overall. As shown in Table 5.2, there was a substantial decline in LOS in each RIC except the extremely small burn RIC where LOS increased. There was also a shift in the LOS distribution, with a greater proportion of cases being discharged at the average LOS (ALOS) for the payment group. Overall, the proportion of cases discharged at the ALOS for their CMG increased from 5.3 percent in 1999 to 7.3 percent in 2002. In many RICs the average LOS became the modal LOS. There was also an increase, albeit a smaller one, in the proportion of cases discharged a day short of the average LOS and a decrease in the proportion discharged a day after the average LOS. These patterns are consistent with anecdotes about the average LOS being treated as a target or ceiling under the PPS. However, these patterns are not inconsistent with the general decrease in LOS so it is

important to look at changes across the distribution. Figure 5.2 shows the shifts in the LOS distribution for the largest CMG within each of the three largest RICs. In each CMG, the distribution in the figure combines data from all 3 tiers as well as the cases with no relevant comorbidity. The expected average LOS for that CMG was calculated from the tier specific averages published in the federal register and the distribution of the CMG by tiers[15]. This average is shown as a vertical line. In the largest stroke CMG (114) it is clear that rather than the LOS shifting to the left, the percent at or just below the ALOS increased and the percent more than two days above it decreased. The same is true of the largest hip fracture CMG (705). In the largest joint replacement CMG (803), however, it does not appear that there was a shift toward the ALOS. Rather, the number of cases discharged at the mode increased and fewer cases were discharged with stays longer than the ALOS. Overall, the shifts are small but consistent with expected reactions to the PPS.

Although we do not present details, the 2002 LOS for all PPS cases in each RIC was very similar to the LOS for all 2002 cases in that RIC. Consistent with the data in Table 5.1, the PPS LOS was very close to the non-PPS LOS -- typically 0.1 to 0.2 days longer.

The percentage decline between 1999 and 2002 was greater for freestanding hospitals than for units. However the average LOS during 2002 remained substantially higher in freestanding IRF than in units in almost all RICs.

5.2 Changes in resource use by types of IRF

5.2.1 LOS and Case Cost

Table 5.3 gives data on the cases for which we can estimate case cost using the departmental accounting method. The hospitals used in Table 1 provided 98.7 percent of all 1999 bundled cases and 97.6 percent of all 2002 bundled cases and thus we expect that all the means in the table adequately represent the entire population of Medicare IRF patients in these two years.[16]

---

[15] The average LOS varies very little by tier in these CMGs, except for the few tier 1 cases. In the other tiers, and for the no tier cases, the average LOS for CMG 114 is either 32, 33 or 34; for CMG 705, it is either 21 or 23; for CMG 803 it is 10 or 11.

[16] IRFs that began operation in 2001 and 2002 are probably under-represented because cost report information may not yet be available for them. However, while these IRFs may be more costly than others, given the small number of cases in these facilities our results are highly unlikely to be affected.

The first line in Table 5.3 shows that average cost per case declined by 0.6 percent between 1999 and 2002. Since, as we saw above, LOS declined by a much greater percent (12.8 percent), the cost per day increased by 14.1 percent. This exceeds the three-year increase in the market basket of 10.9 percent[17], suggesting approximately a 3.2 percent increase in real resources used per day. Thus, some of the savings from the decrease in LOS went to providing more resources during the time the patient was in the IRF.

The rest of the table is arranged to compare cases at hospitals with specific characteristics. In examining differences in cost and LOS across types of hospitals, it is important to remember that the differences may be due to differences in case mix and/or wage index. In discussing this table we will concentrate on the changes observed in each group, thus allowing the group in the earlier period to be its own control. Changes we see may be due to case mix changes, but are unlikely to be due to changes in input prices. IRFs that ceased to care for Medicare beneficiaries under the same provider number had substantially higher costs in 1999 than continuing IRFs. Similarly, IRFs that started after 1999 cost more than other IRFs in 2002. Consequently, continuing IRFs had less of a decline in LOS (12.7 percent) and less of an increase in cost than the average IRF (13.9 percent increase in daily costs or 3 percent more than the market basket cost increase).

Rural hospitals had a greater increase in Medicare volume than urban hospitals, similar declines in LOS, and slightly greater increases in cost per day. There also were variations across the census divisions. The greatest increase in volume occurred in the West South Central and Mountain divisions. The largest declines in LOS occurred in New England, the Middle Atlantic, and West South Central, all of which had higher than average LOS in 1999. Similarly, the smallest decline in LOS occurred the Mountain Division, which had the smallest LOS in 1999. Thus, the changes resulted in more uniformity in LOS across the country. The Pacific Division, however, remained the most costly on both a per case and per day basis.

There were large differences in the changes made by units and freestanding IRFs during this period, and by types of IRF ownership. Freestanding hospitals had greater

[17] The market basket increase was calculated by us from the quarterly moving averages for 2000 through 2002 found in www.cms.hhs.gov/statistics/market-basket/excluded-capital.asp.

increases in volume, greater declines in LOS and a smaller increase in daily cost. Despite the greater decline in LOS, the average LOS was longer in freestanding hospitals than in units in 2002. However the differences between units and freestanding IRFs in daily cost actually increased with units having a 32 percent greater daily cost than freestanding hospitals in 2002. Proprietary hospitals increased volume more than average, decreased LOS more than average, increased daily cost less than average and continued to have higher LOS and lower daily costs in 2002. These changes are related to the changes in freestanding status, as two-thirds of proprietary cases and of freestanding cases are in facilities that are both freestanding and proprietary.

Facility size has a u-shaped relationship with the cost of a case. For both units and freestanding hospitals, the smaller facilities are the most expensive, especially in terms of daily cost. Larger freestanding facilities had the largest increase in volume. Among units, the smallest units had the largest increase in volume. This difference in growth pattern had little effect in the relative growth rate of daily cost in units and freestanding hospitals, however, because small IRFs where costs are greater had only a small change in market share within either group.[18]

The data on disproportionate share show clearly that, within each year, costs and LOS increase with the percentage of patients who have a low income. (The statistics on changes within DSH ratio categories may be slightly confounded by the percentage of cases for whom DSH data are not available in 2002.)

5.2.2 Therapy Costs

Table 5.4 shows the percent of costs that are due to therapy and the average daily therapy costs in 1999 and 2002. The average LOS is repeated from Table 5.3 for ease of comparison. Therapy accounted for 24.4 percent of 1999 costs and 23.2 percent of 2002 costs.[19] This decline in the proportion of costs due to therapy was 5.1 percent for all cases and 4.7 percent for IRFs that operated in both years. The decline is less than the decline in LOS so average daily therapy costs increased by 8.3 percent overall and 8.6 percent in hospitals present in both years.

---

[18] Small units cared for 14.1 percent of unit cases in 1999 and 14.5 percent of unit cases in 2002; small freestanding IRFs cared for 7.3 percent of freestanding cases in 1999 and 7.0 in 2002.

[19] The majority of non-therapy costs are for nursing care and other routine per diem services (meals, janitorial service, linen, etc.). However, non-therapy ancillaries (such as diagnostic tests, pharmacy) cost about 70 percent as much as therapy.

Differences in therapy costs between urban and rural areas are not large and did not change much. There is a greater range across census divisions in the percentage of costs due to therapy in 2002 than in 1999. The regions where we estimate the lowest proportion of costs from therapy and lowest average therapy costs are New England and the Middle Atlantic in both years, and those with the highest proportion are the East North Central and West South Central. The Pacific Region, which had the highest daily cost in 1999, had the greatest percentage increase in daily therapy costs.

The differences across other categories in percentage of costs from therapy are not nearly as large as those for census divisions. Units had a higher percentage of costs for therapy in 1999 than freestanding facilities and this difference increased slightly in 2002. Differences in the proportion of costs from therapy were similar for non-profit and proprietary hospitals in both years, with local government-run hospitals having a slightly lower percentage. In 1999, the percentage of costs from therapy declined with increasing low income percentage, but by 2002 this relationship was no longer evident.

5.3 Payment-to-cost ratios in 2002

5.3.1 Facility characteristics

We next present the ratio of average payment to average cost for 2002 cases. The sample differs from that in Table 5.3 in that it is restricted to cases with a good match to the IRF PAI and for whom we have all necessary payment parameters (wage index, rural status, DSH fraction, CCR, and covered charges) to calculate outlier payments.

The first row of Table 5.5 shows the average payment would have been $12,599 if all Medicare cases discharged during CY 2002 had been paid 100 percent under the PPS. The average weight per discharge was 0.97. The average bundled cost of $10,790 differs by only one percent from that of the population in Table 5.3. However, in this table we are able to standardize costs with the parameters that are used for payment in the PPS -- case mix, area wage index, rural status, and DSH. This column allows comparison of relatively costliness across hospital groups after controlling for their patient mix and characteristics.

PPS payments are substantially higher than cost. This is not surprising given the lack of cost growth per case since 1999, the increase in the payment rate by the actuary to account for payment trends under TEFRA, and changes in coding which may have

increased the weight per discharge. The average payment is estimated to exceed average cost by 16 percent as shown in the last column of Table 5.5, first row.

The remaining rows in the table compare groups of hospitals. The extra payment provided to rural hospitals in the PPS clearly equalized differences in costs as the PTC ratio for rural hospitals is similar to that for urban hospitals. Most census regions have PTC ratios similar to the national average -- with the 2 North Central regions having the lowest and the East South Central region having the highest. The Pacific region has the highest cost, but also the highest average case-mix weight and consequently a PTC ratio close to average. Freestanding hospitals and proprietary hospitals have by far the highest PTC ratio, due in part to their lower than average costs and in part to their higher than average case weight. There is substantial overlap between these two groups – 63 percent of freestanding IRFs are proprietary and 45 percent of proprietary IRFs are freestanding. The very smallest freestanding facilities and units have the lowest PTC ratios.

The last set of lines in the table, for DSH, CMI hospital quartiles, and teaching status, provide information about aspects of the payment system. The PTC ratios by DSH categories are roughly similar to the national average and exhibit no trend, suggesting that the relative payments for low income percentage are appropriate. However, the strong increase in PTC ratios for the CMI quartiles indicates a need to recalibrate the weights.

At the moment, there is no adjustment of PPS payments for the indirect cost of medical education (IME). The last section of the table shows that PTC ratios were lower for teaching hospitals, particularly those with more than 1 resident for every 10 patients, than for non-teaching hospitals. This may indicate a need to provide an IME adjustment in a refined PPS.

5.3.2 Case Characteristics

Table 5.6 shows information on PPS payments, case weights, costs, and PTC ratios by the tier and RIC assigned to the case. Although, as expected, costs are substantially higher for the small number of tier 1 cases than for others, the increase in payments more than offsets the higher tier 1 payment, and produces the highest PTC ratio of any tier group. The overpayment of tier 1 cases and the smaller relative overpayment

of the other tier cases show the need to refine the definition of tier and recalibrate the weights.

Average federal payment and average case weight are correlated at 0.98 across RICs showing that the basic effect of impairment on the payment system is appropriate. However, the data by RIC also show some variation in PTC and, therefore, the need to recalibrate the weights and possibly refine the CMGs. The smaller RICs tend to have the largest deviation from the average PTC ratios. Burns (RIC 21) and osteoarthritis (RIC 12) are relatively under paid; major multiple trauma with brain or spinal cord injury (RIC 18) and non-traumatic brain injury (RIC 3) are among those relatively over paid.

The largest RIC, RIC 8 (lower extremity joint replacement), is the lowest cost of the RICs with average payment, cost, and case weight being 70 percent of that of an average case. It is also one of the least well-paid RICs, but still has a PTC ratio of 1.14.

5.4 Conclusions

Length of stay in IRFs has been declining at least since 1998. There was a particularly large decline in the number of cases with extremely long LOS and an increase in the percentage of cases in most payment groups discharged at the ALOS. The rate of decline increased throughout this period and average LOS declined 5.8 percent from 2001 to 2002, the first year of the PPS. Average LOS declined within each RIC between 1999 and 2002, the two years for which we have case mix data.

The rate of decline in LOS varied across groups of hospitals. In general, hospitals that had long LOS in 1999 had greater percentage declines between 1999 and 2002, thus increasing the uniformity of IRF LOS across the country and across types of hospitals. For example, freestanding hospitals' LOS decreased by 16 percent between 1999 and 2002, while units' LOS decreased only 11.4 percent. But freestanding LOS was higher in both years and closer to unit LOS in 2002 (14.9 vs. 12.2 days) than in 1999 (17.8 vs. 13.7 days).

The average cost per case declined by 0.6 percent between 1999 and 2002. Since LOS declined by a much greater percent, the cost per day increased by 14.1 percent. This exceeds the three-year rate of increase in the market basket of 10.9 percent. Therapy costs increased 8.6 percent per day in the same period, thus decreasing the percentage of costs devoted to therapy from 24.4 percent to 23.2 percent.

The rate of change in average case costs and daily costs also varied across groups of hospitals. Unlike LOS, case costs and daily costs did not become more uniform across hospital groups or regions. For example, in 1999, freestanding cases cost approximately $200 more than units. By 2002, freestanding cases cost $750 less than units.

If all hospitals were 100 percent on the PPS throughout all of 2002, PPS payments during 2002 would have been 17 percent higher than costs. This is the combined result of the lack of cost growth per case since 1999, the increase in the payment rate by the actuary to account for payment trends under TEFRA, and changes in coding. PTC ratios varied across groups of hospitals, with the largest values being for freestanding and proprietary hospitals (1.26 and 1.28 respectively).

The PTC ratios show the effectiveness of the payment adjustments, with only small variations between rural and urban areas, and by DSH categories. Although payment largely followed costs by RIC and tier, variations in the PTC ratio across these categories show the need to refine the payment parameters of the PPS. There also was a positive correlation between PTC ratio and hospital CMI quartile. In addition to demonstrating that the current weights are inappropriate for the coding practices prevalent in 2002, this may indicate that coding practices varied across hospitals with those in the highest CMI quartile responding most completely to the PPS incentives, or even upcoding.

Appendix 1: CMI Calculation

A case mix index (CMI) is the average of the case weights assigned to some specified set of patients (cases). The case weights are relative weights -- i.e. they provide expected cost of each CMG relative to each other CMG. CMGs depend on patient age, impairment, functional status, tiers, length of stay and whether the patient died in the hospital. In the IRF PPS the weights were calculated from the matched data set for 1999. They were normalized so that each weight gives the cost of a case in the CMG relative to the average case in the data set. In calculating the average cost of a case, short stay transfer cases are counted as only a fraction of a case. Thus, the CMI in the data set is 1.0 when short stay cases are counted as only a fraction of a case.

We calculated the CMI used here from the CMG assigned by IRVEN and the discharge destination and LOS found on the hospital bill. However, one could calculate LOS from IRF PAI data and impute the discharge destination from the discharge setting found on the IRF PAI. The following values have been used in previous analyses:

- Values of i44a of (04,05, 06,07,08,09, 12, and 13) are transfers;
- Values of i44a of 11 is a patient that expired in the hospital; and
- All other values of i44a are deemed returned to community.

Using these data, the case mix index was calculated as described in the five steps below.

Step 1: Categorize cases into transfers, deaths, and other.
Step 2: Assign the final CMGs.
If the case is not a transfer and if the LOS is <=3 then assign the case to 5001,
If the case is a death case with LOS > 3 use impairment code (or admission CMG) and LOS to assign the case to one of 5101, 5102, 5103, or 5104. (Orthopedic is RIC 7,8, or 9. 5101 is orthopedic with 3 < LOS <=13; 5102 is orthopedic with LOS >= 14; 5103 is non-orthopedic 3 < LOS <= 15; 5104 is orthopedic with LOS >=16.)
If neither of the above then assign the final CMG equal to the admission CMG. (I.e., if the case is a transfer case with any LOS, or if LOS > 3 and either the case was deemed to have returned to the community or expired.)
Step 3: Determine how much each case is counted in the CMI. For transfer cases only, compare the LOS of the case with the average LOS in the final CMG (same as the admission CMG) from Table 1 of the Addendum to the final regulations. Designate the case a short stay transfer if and only if LOS + 0.5 < average LOS in CMG. If case i is a

short stay transfer, set x(i) = (LOS + 0.5)/average LOS in CMG. For cases that are not short stay transfers, set x(i) = 1.
Step 4: Retrieve the weight for the final CMG from Table 1 of the addendum. Put the weight for the ith case in w(i).
Step 5: Calculate the CMI as:
Sum(x(i)*w(i))/sum((x(i))) where the summation is over all cases with valid data in the data set.

References

Angelelli J, Gifford D, Intrator O, Gozalo P, Laliberte L, Mor V. (2002). Access To Postacute Nursing Home Care Before And After The BBA. *Health Affairs, 21*(5): 254-264.

Beeuwkes Buntin M, Escarce J, Hoverman C, Paddock SM, Totten M, Wynn BO. (2005). Effects of Payment changes on Trends in Access to Post-Acute Care. TR-259-CMS, Santa Monica, CA: RAND.

Carter GM, Beeuwkes Buntin M, Hayden O, Kawata JH, Paddock SM, Relles DA, Ridgeway GK, Totten M and Wynn BO. (2002). Analyses for the Initial Implementation of the Inpatient Rehabilitation Facility Prospective Payment System. MR-1500-CMS, Santa Monica, CA: RAND.

Carter GM, Newhouse JP, and Relles DA. (1991). Has DRG Creep Crept Up?: Decomposing the Case Mix Index Change Between 1987 and 1988. R-4098-HCFA/ProPAC, Santa Monica, CA: RAND.

Chan L, Koepsell TD, Deyo RA, Esselman PC, Haeselkorn JK, Lowery JK, Stolov WC. (1997). The effects of Medicare's payment system for rehabilitation hospitals on length of stay, charges, and total payments. *New England Journal of Medicine,* 337(14): 978-985.

Centers for Medicare & Medicaid Services (CMS) (2001). Medicare Program; Changes to the Hospital Inpatient Prospective Payment Systems and Fiscal Year 2003 Rates; Proposed Rule. *Federal Register*, 67(90): 31452.

Ellis RP and McGuire TG. (1996). Hospital response to prospective payment: moral hazard, selection, and practice-style effects. *Journal of Health Economics*, 15: 257-277.

Kahn KL, Draper D, Keeler EB, Rogers WH, Rubenstein LV, Kosecoff JB, Sherwood MJ, Reinisch EJ, Carney M, Kamberg CJ, Bentow SS, Wells KB, Allen HM, Reboussin D, Roth CP, Chew CF, Brook RH. (1992). The effects of the DRG-based prospective payment system on quality of care for hospitalized Medicare patients: Final report. R-3931-HCFA, Santa Monica, CA: RAND.

Medicare Payment Advisory Commission (MedPAC). (1998). *Health Care Spending and the Medicare Program: A Data Book.* Washington, DC: MedPAC.

Neu CR and Harrison S. (1988). Posthospital Care Before and After the Medicare Prospective Payment System. R-3590-HCFA, Santa Monica, CA: RAND.

Newhouse JP. (1989). Do unprofitable patients face access problems? *Health Care Financing Review,* 11(2): 33-42.

Paddock SM, Escarce J, Hayden O, Beeuwkes Buntin M. (2005). Changes in IRF Patient Severity following Implementation of the IRF PPS. TR-258-CMS, Santa Monica, CA: RAND.

Stineman MG. (2002). Prospective Payment, Prospective Challenge. *Archives of Physical Medicine and Rehabilitation,* 83:1802-1805.

Uniform Data System for Medical Rehabilitation (UDSmr). (1997). The Guide for the Uniform Data Set for Medical Rehabilitation (Including the FIM™ Instrument),Version 5.1 Buffalo: UDSmr.

White, C. (2003) Rehabilitation Therapy in Skilled Nursing Facilities: Effects of Medicare's New Prospective Payment System. *Health Affairs* 22(3): 214-223.

Yip JY, Wilber KH, Myrtle RC. (2002). The Impact of the 1997 Balanced Budget Amendment's Prospective Payment System on Patient Case Mix and Rehabilitation Utilization in Skilled Nursing. *The Gerontologist, 42*(5): 653-660.

Table 2.1: Number of cases in each year in the longitudinal analyses

Year	Number of bundled Medicare bills
1998	366,145
1999	385,457
2000	410,732
2001	442,379
2002	471,984

Table 2.2: Counts of IRF PPS Discharges During CY 2002 Excluded from Sample and Remaining Sample, by Reason for Exclusion

Reason for Exclusion	Excluded Records	Remaining Sample
Total bills	0	473,645
Interrupted stays not paid under PPS	1,661	471,984
No good match to IRF PAI	35,299	436,822
In-hospital death	948	435,676
Atypical short stays	9,695	425,981
Sample Excluding Atypical RICs		425,981
All Bundles		471,984
Missing cost data	11,315	460,669
No good match to IRF PAI	34,047	426,622
No covered charges	1,036	425,586
Missing payment variables	10,417	415,169

Table 2.3: Number of 1999 bundled discharges in population and sample with case mixdata, by unit and freestanding

Type of facility	Population	Sample	% of Sample	Sample weight
Unit	258,326	142,337	55.10	1.164
Freestanding	127,131	104,890	82.51	0.777
Total	385,457	247,227	64.14	1.000

Table 3.1: Increases in the Volume of IRF Facilities and Bundled Discharges,1996-2002 (Excluding Maryland Hospitals) Versus Increases in the Fee-For-Service Discharges

	Facilities		Bundled Discharges		# Discharges per 100,000 FFS Enrollees	
Year	N	Annual % increase	N	Annual % increase	N	Annual % increase
1996	1078		340,424		1000.394	
1997	1121	4.0	355,162	4.3	1064.507	6.4
1998	1153	2.9	366,145	3.1	1118.341	5.1
1999	1163	0.9	385,457	5.3	1183.327	5.8
2000	1169	0.5	410,732	6.6	1243.738	5.1
2001	1196	2.3	442,379	7.7	1298.785	4.4
2002	1202	0.5	471,984	6.7	1344.875	3.5

Note: Maryland Hospitals excluded.

Figure 3.1: Percent of IRF Cases by RIC, 1999 and 2002

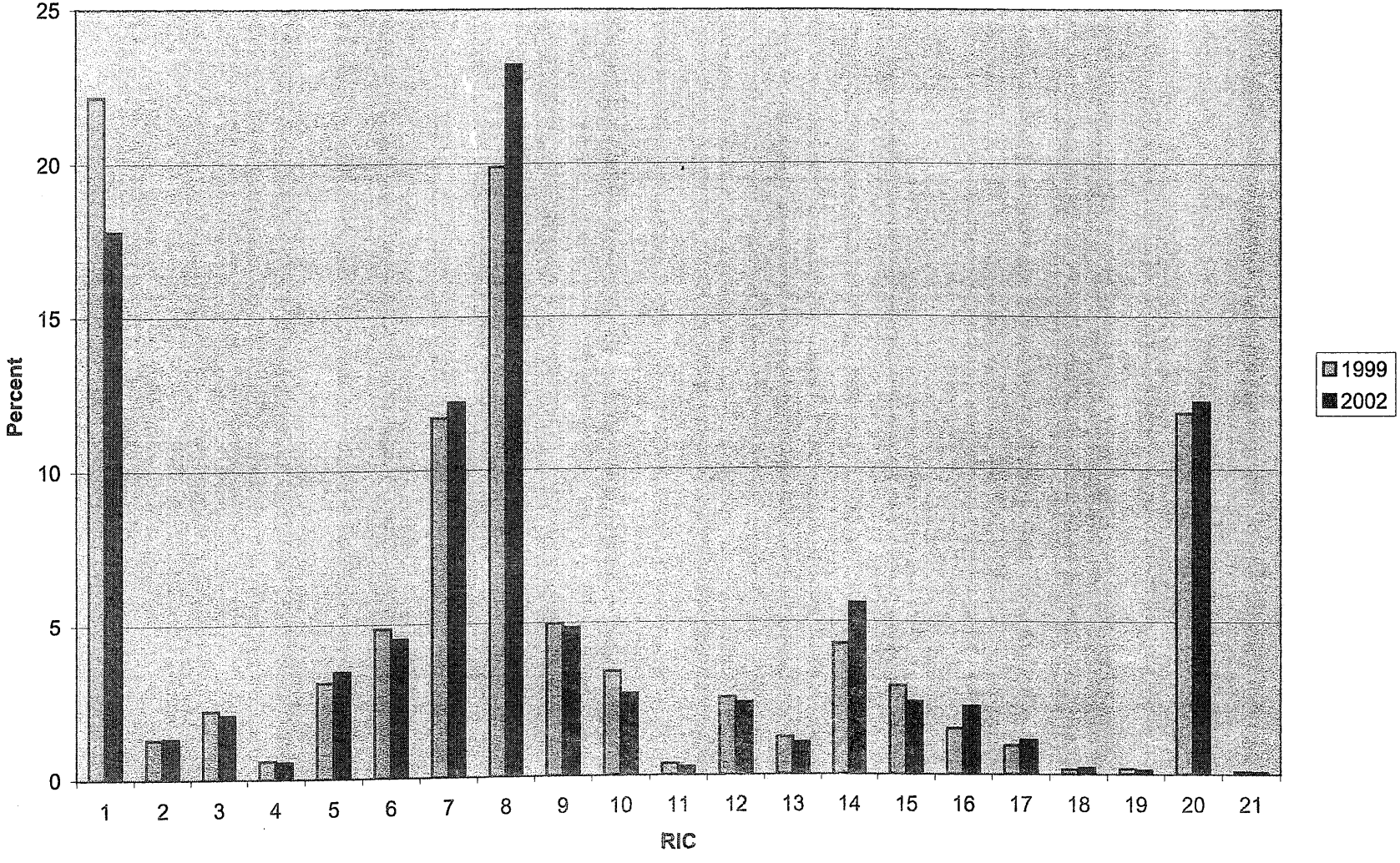


Table 3.2: Distribution of Cases Across RICs for All Cases in 1999 and 2002, and for IRF PPS Cases in 2002: by Freestanding/Unit Status

	Number of Cases			Percent of Cases -- All			Percent of Cases -- Freestanding			Percent of Cases -- Units		
RIC	1999 All Cases	2002 All Cases	2002 PPS Cases	1999 All Cases	2002 All Cases	2002 PPS Cases	1999 All Cases	2002 All Cases	2002 PPS Cases	1999 All Cases	2002 All Cases	2002 PPS Cases
1	54846	75762	54333	22.1	17.8	17.5	20.1	15.7	15.6	23.6	19.0	18.8
2	3186	5587	4069	1.3	1.3	1.3	1.4	1.3	1.3	1.2	1.3	1.3
3	5463	8786	6456	2.2	2.1	2.1	1.9	1.7	1.7	2.5	2.3	2.4
4	1448	2320	1655	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.6	0.6
5	7682	14642	10154	3.1	3.4	3.3	2.4	2.5	2.3	3.6	4.0	4.0
6	12019	19132	14089	4.9	4.5	4.5	5.0	4.0	4.0	4.7	4.8	4.9
7	28984	52019	37558	11.7	12.2	12.1	11.6	11.5	11.6	11.8	12.6	12.5
8	49283	98771	72087	19.9	23.2	23.2	18.4	21.7	21.7	21.0	24.0	24.3
9	12312	20557	15822	5.0	4.8	5.1	5.6	6.2	6.5	4.5	4.0	4.1
10	8380	11318	7838	3.4	2.7	2.5	3.1	2.4	2.4	3.6	2.8	2.6
11	918	1144	794	0.4	0.3	0.3	0.4	0.3	0.3	0.4	0.3	0.3
12	6219	10034	6697	2.5	2.4	2.2	3.6	1.9	1.8	1.7	2.6	2.4
13	3016	4444	3163	1.2	1.0	1.0	1.7	1.1	1.1	0.8	1.0	1.0
14	10542	23893	18641	4.3	5.6	6.0	4.6	7.2	7.5	4.0	4.7	4.9
15	7147	10052	7706	2.9	2.4	2.5	4.3	3.7	3.8	1.9	1.6	1.5
16	3697	9415	6788	1.5	2.2	2.2	1.9	2.6	2.4	1.2	2.0	2.0
17	2334	4713	3405	0.9	1.1	1.1	0.9	1.1	1.1	1.0	1.1	1.1
18	379	855	655	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.2
19	414	566	382	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1
20	29315	51948	38542	11.8	12.2	12.4	12.2	14.0	14.3	11.5	11.1	11.0
21	164	220	144	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1
Total	247748	426178	310978	100	100	100	100	100	100	100	100	100

Figure 3.2: Mean Motor Score by RIC, 1999 vs. 2002

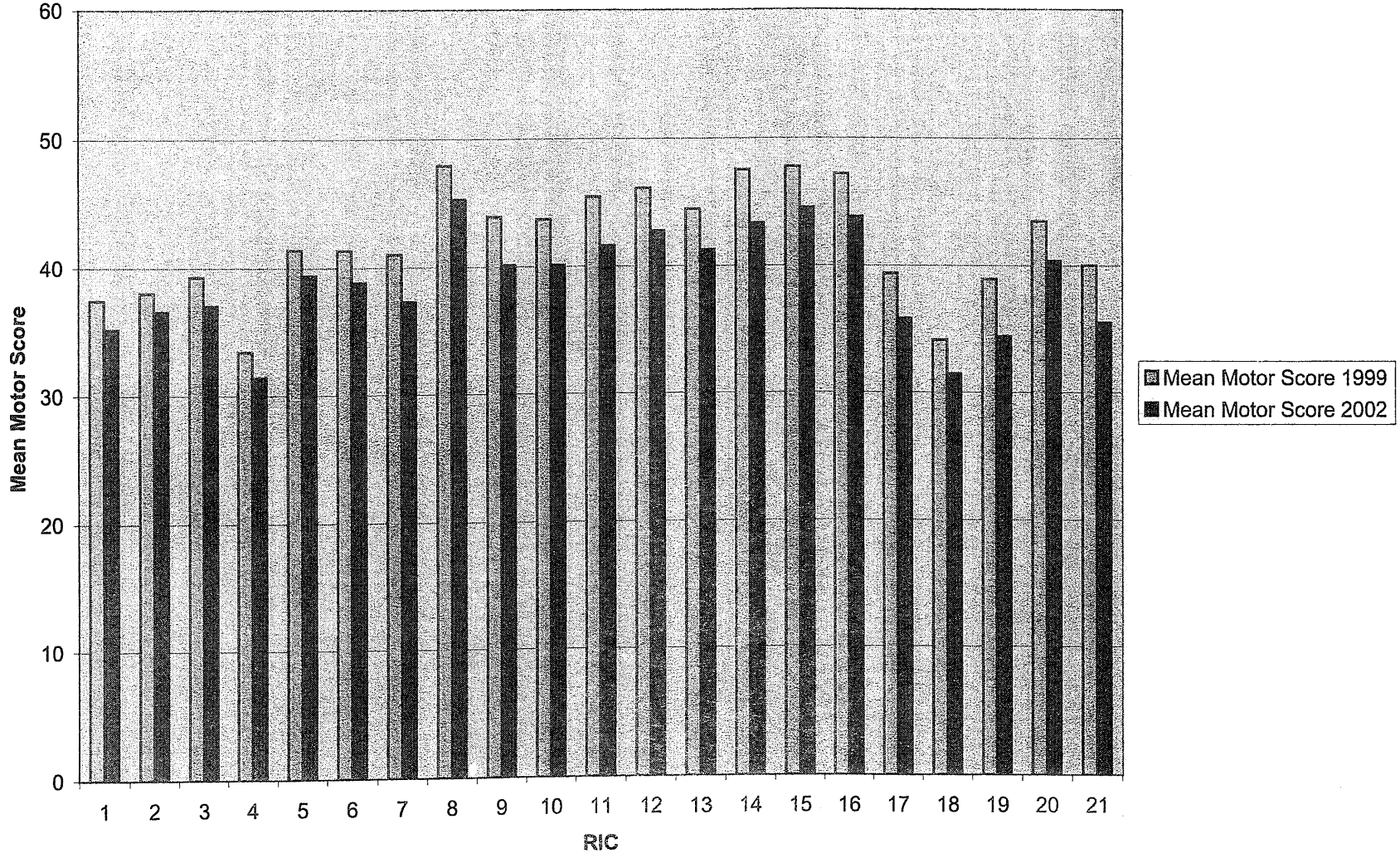


Figure 3.3: Mean Cognitive Score by RIC, 1999 vs. 2002

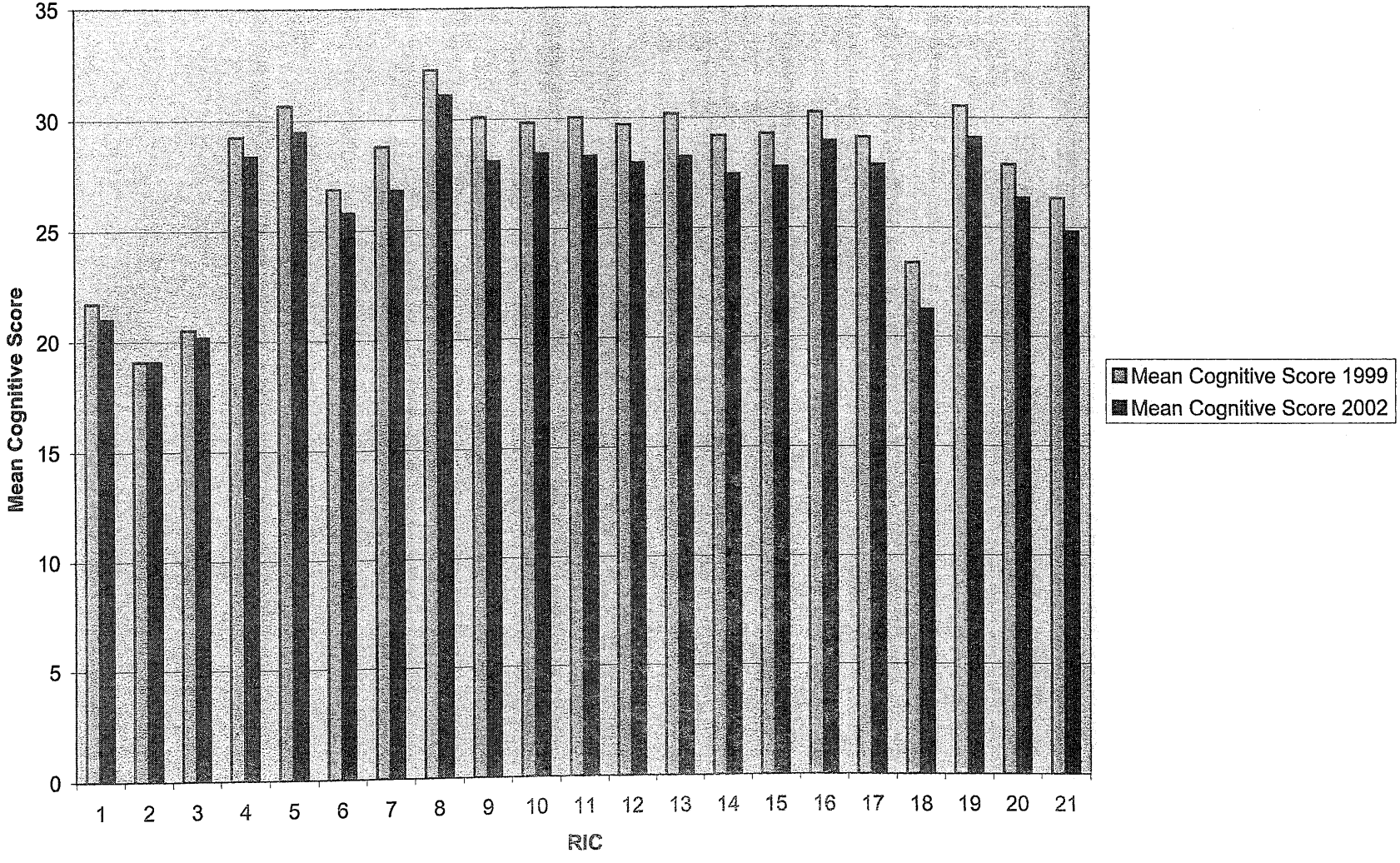


Table 3.3: Mean FIM(TM) Motor and Cognitive Scores for All Cases in 1999 and 2002, and for IRF PPS Cases in 2002: by Freestanding/Unit Status

	All Cases						Freestanding						Units					
	Mean Motor Score			Mean Cognitive Score			Mean Motor Score			Mean Cognitive Score			Mean Motor Score			Mean Cognitive Score		
	1999	2002	2002	1999	2002	2002	1999	2002	2002	1999	2002	2002	1999	2002	2002	1999	2002	2002
RIC	All Cases	All Cases	PPS Cases	All Cases	All Cases	PPS Cases	All Cases	All Cases	PPS Cases	All Cases	All Cases	PPS Cases	All Cases	All Cases	PPS Cases	All Cases	All Cases	PPS Cases
1	37.5	35.2	34.9	21.8	21.0	20.8	36.8	32.1	31.7	20.7	19.0	18.7	37.9	36.7	36.8	22.4	22.0	22.0
2	38.0	36.6	36.2	19.1	19.1	18.9	37.2	34.1	33.6	18.5	17.4	17.2	38.7	38.1	38.0	19.6	20.1	20.0
3	39.3	37.0	36.9	20.5	20.2	20.0	38.1	34.5	34.1	19.3	18.2	17.8	40.0	38.2	38.3	21.2	21.1	21.1
4	33.5	31.4	31.2	29.3	28.4	28.6	33.5	27.9	27.5	29.3	28.1	28.1	33.4	33.5	33.7	29.2	28.6	28.9
5	41.4	39.4	39.3	30.7	29.5	29.4	40.8	36.7	36.5	30.3	28.9	28.6	41.7	40.4	40.4	30.8	29.7	29.7
6	41.4	38.8	38.6	26.9	25.8	25.6	41.4	36.7	36.6	26.3	24.6	24.4	41.4	39.9	39.7	27.4	26.4	26.3
7	41.1	37.3	36.9	28.8	26.8	26.5	40.7	34.8	34.2	28.2	25.5	25.1	41.3	38.6	38.6	29.3	27.5	27.5
8	48.0	45.3	45.0	32.2	31.1	30.9	48.5	43.9	43.4	32.1	30.4	30.2	47.7	46.0	46.0	32.3	31.4	31.4
9	43.9	40.2	39.6	30.1	28.1	27.8	44.2	37.9	37.5	29.7	26.7	26.4	43.7	42.2	42.1	30.4	29.4	29.4
10	43.7	40.1	39.8	29.9	28.4	28.3	44.3	38.7	38.4	29.5	27.6	27.3	43.4	40.8	40.7	30.1	28.9	28.9
11	45.4	41.6	41.3	30.1	28.3	28.0	45.3	38.7	38.5	29.8	26.3	26.0	45.6	43.4	43.3	30.3	29.5	29.4
12	46.2	42.8	42.3	29.7	28.0	27.6	46.3	40.0	39.5	29.7	26.2	26.0	46.0	44.0	43.7	29.7	28.7	28.5
13	44.5	41.3	40.7	30.2	28.3	27.9	45.0	39.5	38.9	30.2	27.0	26.6	43.7	42.4	42.2	30.3	29.1	29.1
14	47.6	43.4	43.2	29.2	27.5	27.2	48.1	41.4	41.1	29.0	26.1	25.7	47.1	45.1	45.5	29.5	28.7	28.8
15	47.8	44.5	44.5	29.3	27.8	27.5	48.4	44.1	43.9	29.2	27.2	26.8	46.8	45.1	45.6	29.6	28.6	28.7
16	47.2	43.8	43.6	30.2	29.0	28.7	47.9	42.7	42.1	30.3	28.4	27.9	46.5	44.7	44.8	30.2	29.4	29.4
17	39.4	35.8	35.3	29.2	27.9	27.6	39.4	33.2	32.6	28.8	26.7	26.4	39.4	37.4	37.2	29.4	28.6	28.5
18	34.2	31.5	31.3	23.4	21.3	21.0	34.0	30.1	30.1	23.9	20.0	19.9	34.3	32.8	32.7	23.1	22.5	22.3
19	38.9	34.4	34.0	30.5	29.1	28.8	39.8	32.3	32.5	30.4	27.9	28.0	38.5	35.6	35.1	30.6	29.8	29.3
20	43.5	40.4	40.1	27.9	26.4	26.0	43.7	38.4	38.0	27.4	24.9	24.6	43.4	41.9	42.0	28.3	27.4	27.4
21	40.1	35.5	34.3	26.3	24.8	24.2	41.2	32.3	31.4	25.9	24.5	24.0	38.8	37.0	35.9	26.8	24.9	24.3
Total	42.8	40.2	40.0	27.7	26.8	26.6	43.0	38.4	38.0	27.3	25.6	25.3	42.7	41.3	41.4	28.0	27.5	27.4

Figure 3.4: Cumulative Distribution of All Cases in RIC 1 (Stroke) by CMG, 1999 versus 2002

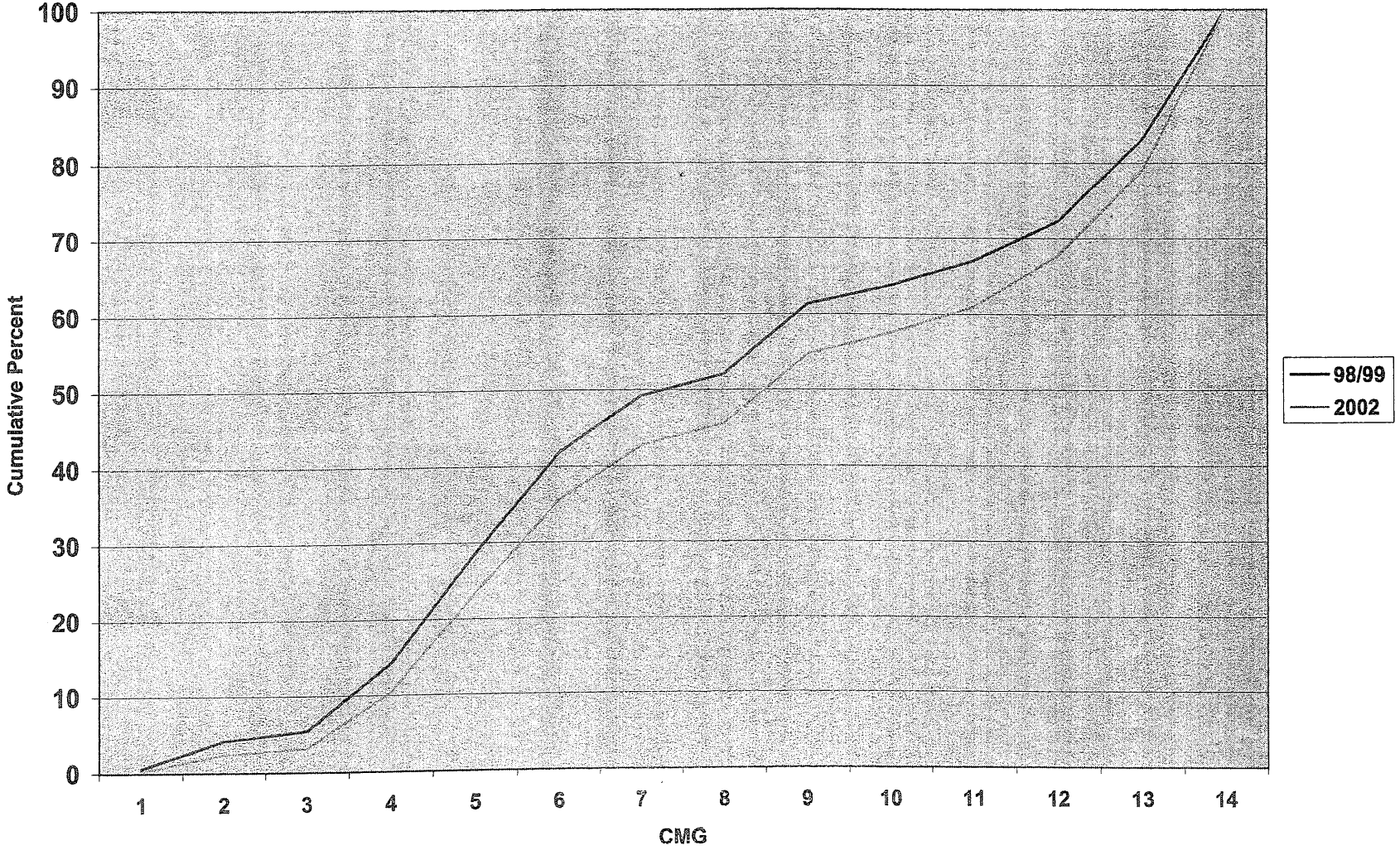


Figure 3.5: Comorbidity Tier Assignments for All Hospitals, for All Cases in 1999 and 2002, and for IRF PPS Cases in 2002: by Freestanding/Unit Status

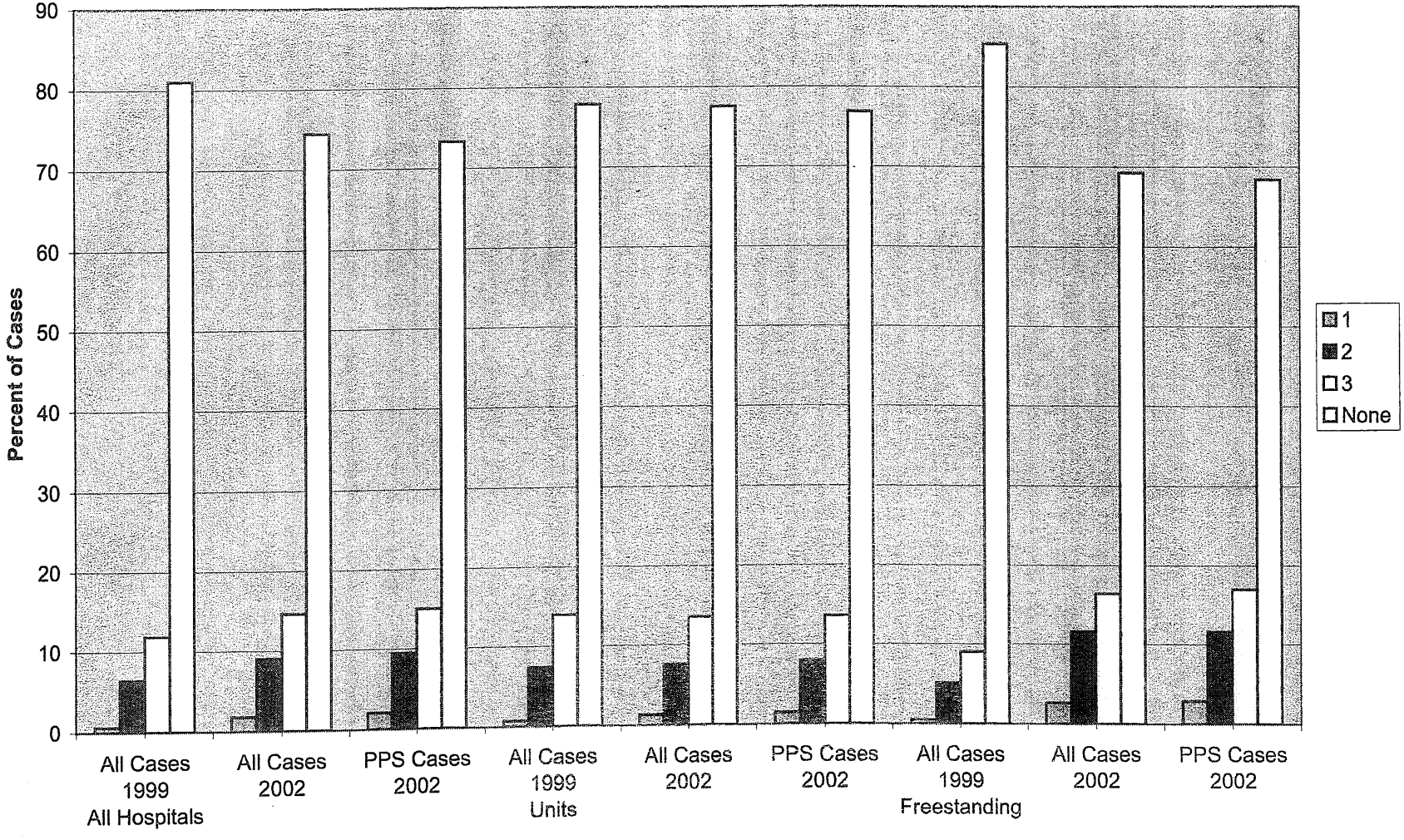


Table 3.4: Percent of Cases by RIC in Each Comorbidity Tier: All Cases in 1999 and 2002, and for IRF PPS Cases in 2002

	Tier 1			Tier 2			Tier 3			None		
RIC	1999 All Cases	2002 All Cases	2002 PPS Cases	1999 All Cases	2002 All Cases	2002 PPS Cases	1999 All Cases	2002 All Cases	2002 PPS Cases	1999 All Cases	2002 All Cases	2002 PPS Cases
1	0.6	1.6	1.9	2.9	4.2	4.5	11.3	14.3	14.7	85.2	79.9	78.8
2	2.4	3.5	3.9	14.7	15.8	16.6	18.0	17.4	17.7	64.9	63.2	61.7
3	1.2	3.0	3.1	14.7	18.1	18.5	23.8	23.4	24.1	60.3	55.4	54.3
4	3.0	4.7	4.9	10.2	13.2	13.3	11.9	11.9	12.2	74.9	70.3	69.6
5	0.7	1.5	1.6	7.7	9.0	9.4	10.7	13.5	14.0	81.0	76.0	75.0
6	0.7	2.1	2.4	10.9	15.3	15.6	13.8	15.2	15.0	74.6	67.3	67.1
7	0.2	1.4	1.7	4.3	6.9	7.4	7.6	10.3	10.6	87.8	81.4	80.3
8	0.1	0.5	0.6	3.5	4.1	4.4	5.0	8.6	9.1	91.4	86.8	85.9
9	0.3	1.2	1.4	4.7	7.4	7.8	9.0	13.4	13.7	86.0	78.0	77.1
10	0.4	1.5	1.8	9.8	18.5	18.9	31.5	30.1	31.3	58.2	50.0	48.0
11	0.1	1.4	1.5	16.1	25.8	27.6	41.4	35.7	36.0	42.4	37.2	34.9
12	0.3	1.2	1.4	4.3	8.0	8.4	8.3	16.3	16.9	87.2	74.4	73.3
13	0.3	1.2	1.4	5.8	11.2	11.2	10.1	17.6	17.6	83.8	70.0	69.7
14	1.1	2.6	3.0	10.6	13.9	14.4	16.0	23.6	24.1	72.3	59.9	58.6
15	0.4	1.8	2.1	8.5	14.5	15.0	6.9	12.7	12.6	84.2	71.0	70.3
16	0.3	0.7	0.9	5.4	5.9	6.1	8.5	12.6	12.9	85.8	80.8	80.1
17	1.3	2.3	2.7	4.5	8.7	9.2	10.1	12.5	12.5	84.1	76.5	75.5
18	3.7	11.0	11.6	14.2	16.4	16.6	11.6	13.7	13.6	70.4	58.9	58.2
19	1.7	5.7	6.8	13.3	14.3	16.0	15.0	14.3	14.4	70.0	65.7	62.8
20	1.7	4.4	4.8	13.3	18.3	18.8	21.4	22.2	22.4	63.6	55.1	53.9
21	1.8	8.6	9.0	11.0	20.5	21.5	19.5	12.7	12.5	67.7	58.2	56.9
Total	0.6	1.8	2.0	6.4	9.0	9.5	11.9	14.6	15.0	81.0	74.5	73.4

Table 3.5: Change in Case Mix Index (CMI) between 1999 and 2002

	Number of Facilities		Number of Discharges		Number of Equivalent Cases		Case Mix Index		% Increase in CMI
	1999	2002	1999	2002	1999	2002	1999	2002	
All Facilities in Sample	694	1120	247,319	434,815	234,169	404,590	1.0000	1.0434	4.3%
Facilities in Both Years' Data	632	632	235,638	301,545	223,201	280,692	1.0002	1.0579	5.8%

Table 3.6: Percent of cases in each demographic category by year for the sample, 1999 and 2002

	1999	2002
Sample size	254028	445167
Age		
<=44	1.55	1.33
45 to 64	6.92	7.64
65 to 69	12.72	13.29
70 to 74	18.72	18.63
75 to 79	23.11	22.91
80 to 84	19.42	19.95
85 to 89	12.31	11.58
90 to 94	4.34	3.91
>= 95	0.92	0.77
Race		
White	86.66	84.57
Black	9.81	9.25
Other	1.29	0.18
Asian	0.45	0.88
Hispanic	1.23	3.3
North American Native	0.14	0.29
Married	42.9	43.52
Gender		
Male	37.52	36.57
Female	62.48	63.43

Table 4.1: Very Short Stay Cases Discharged Alive by Length of Stay 1999-2002

	1999	2000	2001	2002	1999	2000	2001	2002
Length of Stay	N Cases	N Cases	N Cases	N Cases	% of Total Cases	Total Cases	Total Cases	Total Cases
1 Day	1,679	1,758	1,727	1,240	0.44%	0.43%	0.39%	0.28%
2 Days	2,637	2,987	3,238	2,255	0.68%	0.73%	0.73%	0.52%
3 Days	5,674	6,294	7,066	5,903	1.47%	1.53%	1.60%	1.35%
Total Very Short Stay	9,990	11,039	12,031	9,696	2.59%	2.69%	2.72%	2.22%
Total Cases	385,457	410,732	442,379	436,822				

Table 4.2: Distribution of Interrupted Stays: 1999-2002

No. of Nights Away From IRF	Interruptions By No. of Nights Away from IRF							
	% of Total Discharges				% of Total Interruptions with 0-10 nights away			
	1999	2000	2001	2002	1999	2000	2001	2002
0	0.3%	0.3%	0.3%	0.1%	4.3%	3.7%	4.2%	1.8%
1	0.7%	0.7%	0.7%	0.3%	9.6%	9.2%	9.2%	4.3%
2	0.9%	0.8%	0.8%	0.3%	12.1%	11.6%	11.6%	5.8%
3	1.0%	0.9%	1.0%	1.0%	13.3%	12.9%	13.5%	16.4%
4	1.0%	1.0%	0.9%	1.0%	13.3%	13.4%	13.3%	16.3%
5	0.9%	0.9%	0.9%	0.8%	11.8%	12.4%	12.4%	13.8%
6	0.8%	0.8%	0.8%	0.7%	11.0%	10.9%	10.8%	11.8%
7	0.7%	0.7%	0.6%	0.6%	8.8%	9.0%	8.7%	10.3%
8	0.5%	0.5%	0.5%	0.5%	6.3%	7.0%	7.1%	8.2%
9	0.4%	0.4%	0.4%	0.4%	5.3%	5.3%	5.1%	6.5%
10	0.3%	0.3%	0.3%	0.3%	4.2%	4.3%	4.2%	4.9%
0-2 nights bundles	1.9%	1.8%	1.8%	0.7%	26.0%	24.6%	24.9%	11.9%
0-10 nights interruptions	6.5%	6.5%	6.3%	5.9%	100.0%	100.0%	100.0%	100.0%
Total Discharges	393,069	418,249	450,534	460,928				

Note: Each interruption is counted as two discharges.

Table 4.3: Distribution of Interrupted Stays by Hospital Characteristics

% of total discharges								
No. of Nights Away from IRF	All IRFs	Type of Facility		Location		Type of Ownership*		
		Freestanding	Units	Urban	Rural	Non-Profit	Proprietary	Government
0	0.1%	0.0%	0.2%	0.1%	0.1%	0.1%	0.1%	0.2%
1	0.3%	0.2%	0.3%	0.2%	0.3%	0.3%	0.2%	0.4%
2	0.3%	0.2%	0.4%	0.3%	0.3%	0.4%	0.2%	0.4%
3	1.0%	1.1%	0.9%	1.0%	0.8%	1.0%	1.0%	0.9%
4	1.0%	1.2%	0.9%	1.0%	0.7%	0.9%	1.1%	0.9%
5	0.8%	1.0%	0.7%	0.8%	0.7%	0.8%	0.8%	0.7%
6	0.7%	0.9%	0.6%	0.7%	0.5%	0.7%	0.8%	0.6%
7	0.6%	0.7%	0.5%	0.6%	0.5%	0.6%	0.7%	0.5%
8	0.5%	0.6%	0.4%	0.5%	0.4%	0.5%	0.5%	0.4%
9	0.4%	0.5%	0.3%	0.4%	0.3%	0.4%	0.4%	0.3%
10	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.2%
0-2 nights	0.7%	0.4%	0.9%	0.7%	0.8%	0.8%	0.4%	1.1%
0-10 nights	5.9%	6.7%	5.5%	6.0%	5.1%	5.8%	6.2%	5.6%
Total Discharges	100.0%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
No. of Nights Away from IRF	**% of interruptions with 0-10 nights away from IRF**							
0	1.8%	0.2%	2.8%	1.8%	2.1%	2.0%	0.9%	3.8%
1	4.3%	2.2%	5.6%	4.1%	6.3%	4.9%	2.4%	7.5%
2	5.8%	3.3%	7.4%	5.7%	6.6%	7.0%	3.3%	7.4%
3	16.4%	16.5%	16.3%	16.4%	16.4%	16.4%	16.5%	15.7%
4	16.3%	17.6%	15.4%	16.5%	14.0%	15.6%	17.4%	16.4%
5	13.8%	14.6%	13.3%	13.8%	14.5%	14.1%	13.6%	12.7%
6	11.8%	13.0%	10.9%	11.9%	10.4%	11.4%	12.7%	10.3%
7	10.3%	11.1%	9.8%	10.4%	9.5%	9.6%	11.6%	9.7%
8	8.2%	9.1%	7.6%	8.1%	8.8%	8.0%	8.8%	6.5%
9	6.5%	7.1%	6.1%	6.6%	5.9%	6.3%	7.1%	5.5%
10	4.9%	5.1%	4.8%	4.9%	5.2%	4.6%	5.6%	4.4%
0-2 nights away	11.9%	5.8%	15.8%	11.6%	15.0%	13.9%	6.6%	18.8%
0-10 nights away	100%	100%	100%	100%	100%	100%	100%	100%

*Missing type of ownership for 575 discharges.
Note: Each interrupted stay is counted as two discharges.

Table 4.4: 2002 Bundled Stays by Hospital Characteristics

	All Cases			Non Profit			Proprietary			Government		
Nights Away	N Bundles	Length of Stay	PTC Ratio	N Bundles	Length of Stay	PTC Ratio	N Bundles	Length of Stay	PTC Ratio	N Bundles	Length of Stay	PTC Ratio
0	102	19.7	1.03	46	19.1	0.91	51	20.0	1.13	5	23.8	1.26
1	1,141	20.4	0.92	604	19.5	0.87	451	21.5	1.06	86	20.6	0.74
2	1,221	19.9	0.92	697	19.1	0.83	440	21.5	1.10	84	18.9	0.86
Total Bundles 0-2 nights away	2,464	20.0	0.96	1,347	19.23	0.87	942	21.00	1.10	175	21.10	0.95
Total Discharges	415,126			243,494			138,624			33,008		
	Urban Hospitals			Rural Hospitals			Freestanding Hospitals			Units		
Nights Away	N Bundles	Length of Stay	PTC Ratio	N Bundles	Length of Stay	PTC Ratio	N Bundles	Length of Stay	PTC Ratio	N Bundles	Length of Stay	PTC Ratio
0	96	20.1	1.03	6	14.1	1.16	52	20.0	1.11	50	19.5	0.97
1	1,063	20.4	0.93	78	19.9	0.80	502	21.9	1.03	639	19.2	0.85
2	1,118	20.0	0.92	103	18.4	0.88	495	21.3	1.06	726	18.9	0.84
Total Bundles 0-2 nights away	2,277	20.17	0.96	187	17.47	0.95	1,049	21.07	1.07	1,415	19.20	0.89
Total Discharges	375,148			39,978			154,500			260,626		

Note: Discharges are counted consistent with IRF PPS rules.

Table 4.5: Changes in Transfers Measured by Post-IRF Status

Type of case	1999 Percent of cases	2002 Percent of cases	Percentage Change
Short stay transfers	13.67	15.93	16.56
Other transfers	6.99	4.93	-29.44
Total Transfers	20.66	20.87	0.99
Non-transfers	79.34	79.13	-0.26
Total cases	100	100	0

Table 4.6: Transfers by Discharge Destination

Type of transfer	Percent of Bundled Discharges 1999	2002	Percentage Change
Any	20.66	20.87	1.02
Hospital	7.48	8.68	16.04
SNF/NH	13.19	12.18	-7.66

Table 4.7: Simulated IRF-PPS Payments for All 2002 Bills Assuming 100% Federal Rate by Hospital Characteristic

Category	N Facilities	N Cases	Average Std Pay	Average Outlier Pay	Average Total Fed Pay	N outlier cases	Outlier Pay Per Outlier Case	Outlier Pay as % Total Pay
All facilities	1072	415,169	$12,185.69	$373.59	$12,559	$20,672.00	$7,503.04	2.97
Geographical Area								
Urban	903	375,184	$12,181.14	$391.60	$12,573	$19,172.00	$7,663.33	3.11
Rural	169	39,985	$12,228.46	$204.61	$12,433	$1,500.00	$5,454.31	1.65
Census Region								
New England	37	19,494	$14,074.31	$203.07	$14,277	$551.00	$7,184.63	1.42
Middle Atlantic	150	77,225	$12,118.94	$458.00	$12,577	$3,591.00	$9,849.33	3.64
South Atlantic	140	72,125	$12,161.56	$283.83	$12,445	$3,187.00	$6,423.35	2.28
East North Central	182	62,207	$11,878.91	$138.78	$12,018	$1,627.00	$5,306.26	1.15
East South Central	63	31,435	$12,031.28	$285.14	$12,316	$1,389.00	$6,453.19	2.32
West North Central	97	25,384	$11,286.75	$320.21	$11,607	$1,318.00	$6,167.05	2.76
West South Central	230	82,076	$11,479.67	$415.22	$11,895	$5,551.00	$6,139.34	3.49
Mountain	63	20,573	$11,821.14	$378.26	$12,199	$1,066.00	$7,300.12	3.10
Pacific	110	24,650	$15,523.82	$1,124.44	$16,648	$2,392.00	$11,587.59	6.75
Type of Hospital								
Freestanding	201	154,503	$12,784.10	$161.47	$12,946	$4,283.00	$5,824.97	1.25
Unit	871	260,666	$11,831.01	$499.31	$12,330	$16,389.00	$7,941.57	4.05
Ownership								
Non-Profit	678	243,523	$11,925.99	$370.32	$12,296	$11,747.00	$7,676.96	3.01
Proprietary	277	138,634	$12,624.54	$353.54	$12,978	$7,040.00	$6,961.98	2.72
Government	117	33,012	$12,258.56	$481.92	$12,740	$1,885.00	$8,439.87	3.78

Table 4.8: Simulated IRF-PPS Payments for All 2002 Bills Assuming 100% Federal Rate by RIC and Comorbidity Tier

Category	N Cases	Average Std Pay	Average Outlier Pay	Average Total Fed Pay	N outlier cases	Outlier Pay Per Outlier Case	Outlier Pay as % Total Pay
Comorbidity							
None	311562	$11,372.94	$293.00	$11,665.94	13305	$6,861.17	2.5
1	7385	$18,104.86	$1,161.23	$19,266.09	722	$11,877.67	6.0
2	36832	$15,224.60	$677.40	$15,902.00	2898	$8,609.43	4.3
3	59390	$13,828.78	$510.00	$14,338.78	3747	$8,083.55	3.6
RIC							
1	71191	$16,849.77	$545.53	$17,395.30	4946	$7,852.15	3.1
2	5289	$15,599.43	$550.92	$16,150.34	352	$8,277.87	3.4
3	8288	$15,654.24	$728.93	$16,383.17	602	$10,035.55	4.4
4	2128	$19,166.60	$1,431.78	$20,598.38	244	$12,487.00	7.0
5	13728	$13,723.93	$603.69	$14,327.61	895	$9,259.66	4.2
6	18333	$13,264.45	$512.63	$13,777.08	1192	$7,884.32	3.7
7	49731	$12,435.66	$288.38	$12,724.05	2362	$6,071.82	2.3
8	94285	$8,591.52	$145.10	$8,736.62	2229	$6,137.57	1.7
9	19702	$11,382.89	$232.87	$11,615.76	765	$5,997.39	2.0
10	10688	$14,630.30	$663.13	$15,293.43	826	$8,580.53	4.3
11	1091	$13,361.76	$753.31	$14,115.07	89	$9,234.34	5.3
12	9557	$10,532.73	$299.89	$10,832.62	517	$5,543.58	2.8
13	4264	$11,840.32	$427.61	$12,267.93	262	$6,959.30	3.5
14	22850	$11,208.22	$297.14	$11,505.35	1085	$6,257.65	2.6
15	9591	$12,790.29	$443.61	$13,233.90	598	$7,114.83	3.4
16	9070	$10,205.61	$222.12	$10,427.73	347	$5,805.76	2.1
17	4501	$14,002.78	$437.12	$14,439.90	271	$7,260.12	3.0
18	800	$19,359.01	$1,053.93	$20,412.94	70	$12,044.96	5.2
19	530	$20,715.34	$1,103.93	$21,819.27	66	$8,864.90	5.1
20	49386	$12,305.57	$449.50	$12,755.08	2823	$7,863.69	3.5
21	196	$19,570.94	$6,280.80	$25,851.74	36	$34,195.47	24.3
50	9060	$2,032.58	$1.70	$2,034.29	6	$2,573.16	0.1
51	910	$10,215.25	$1,614.54	$11,829.79	89	$16,508.23	13.6

Figure 5.1: Cumulative distribution of LOS, by year

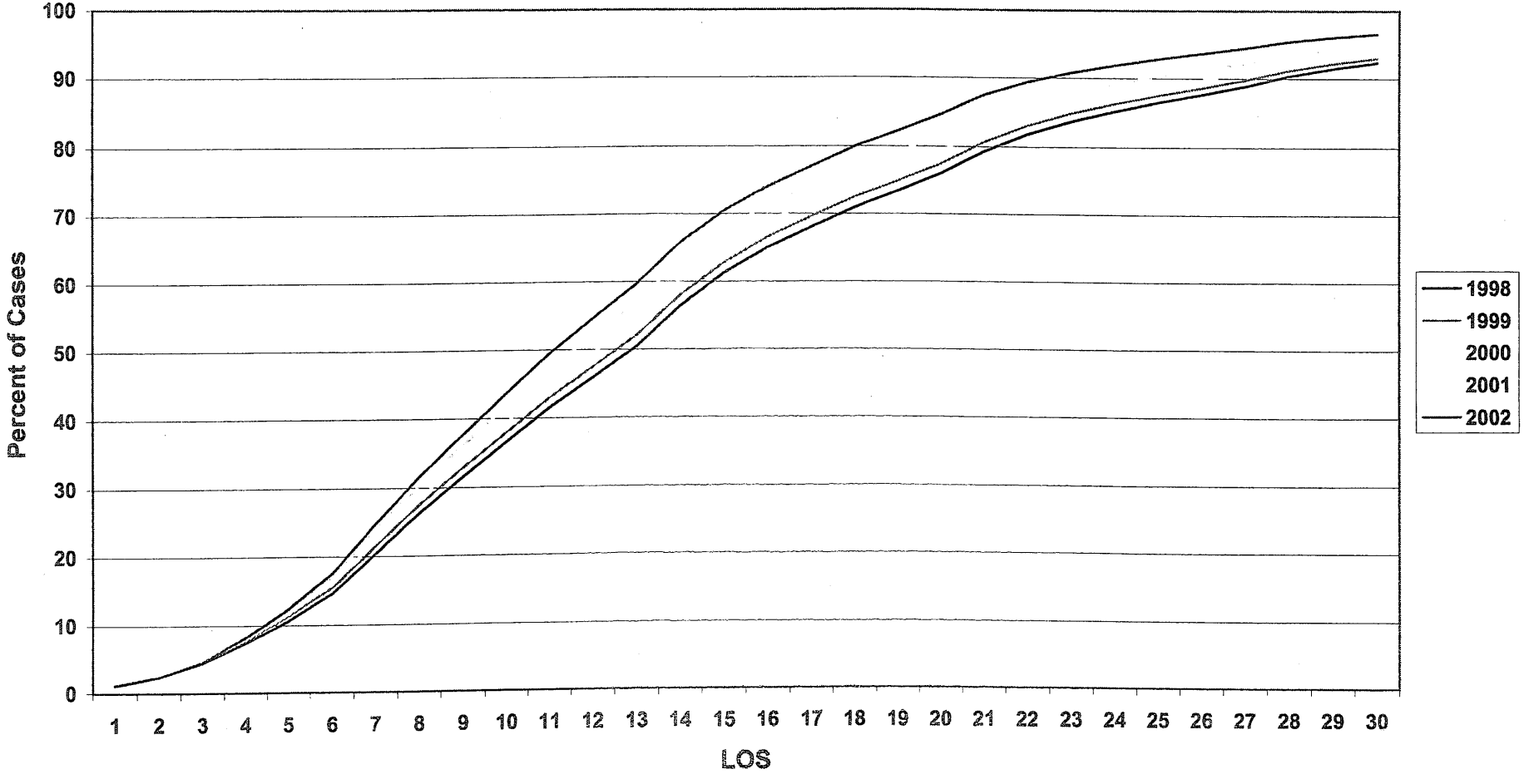


Figure 5.2: Lengths of Stay in 1999 versus 2002, selected large CMGs

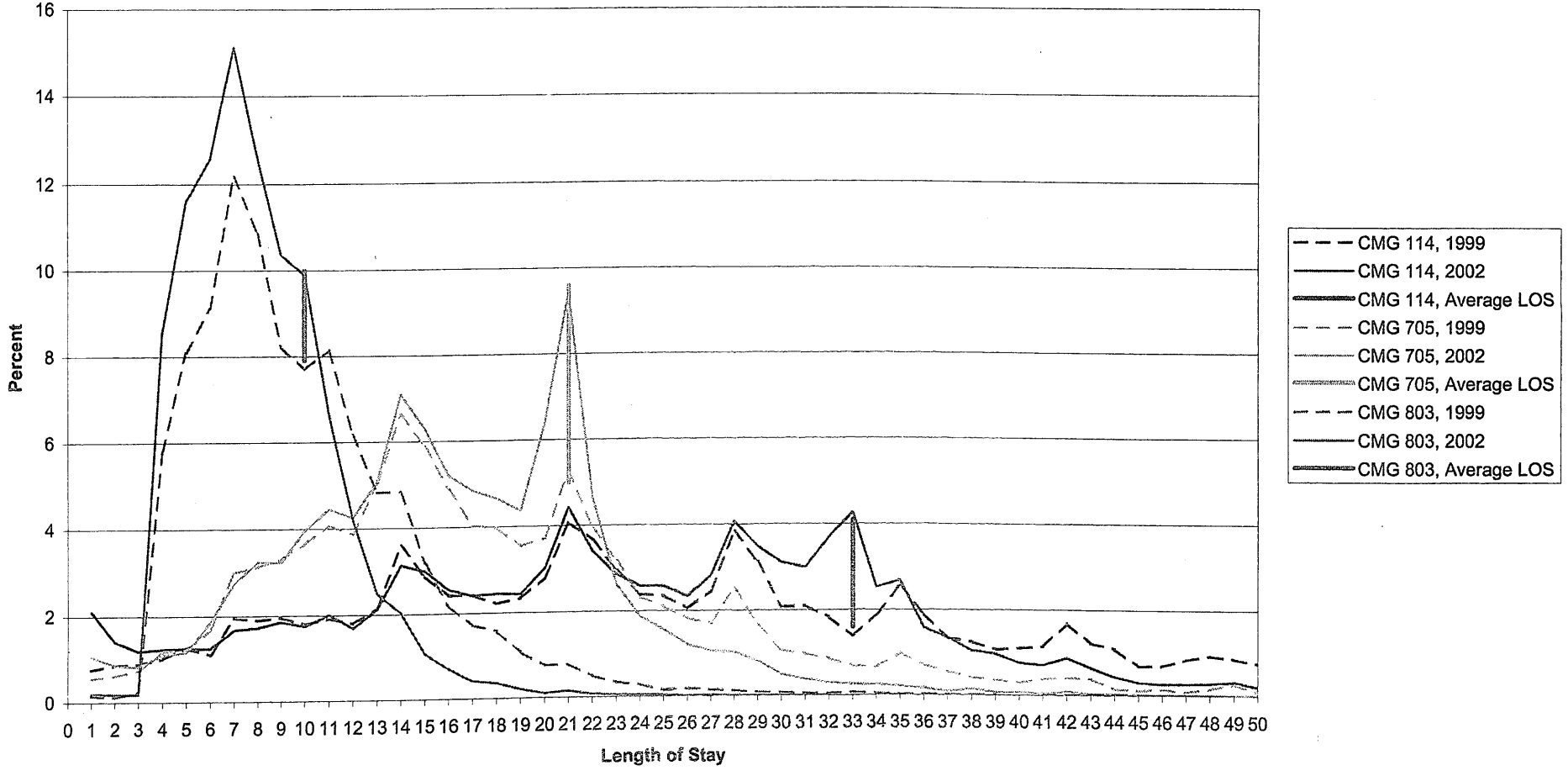


Table 5.1 Mean LOS of bundled discharges declined each year between 1998 and 2002 and recently declined more in freestanding facilities than in units, although LOS within most RICs remains higher in freestanding facilities

	All IRFs		Units		Freestanding	
Year	Mean LOS	% change from previous year	Mean LOS	% change from previous year	Mean LOS	% change from previous year
1998	15.48		14.16		18.18	
1999	15.06	-2.69	13.75	-2.84	17.72	-2.52
2000	14.58	-3.18	13.28	-3.47	17.24	-2.69
2001	13.95	-4.35	12.72	-4.20	16.34	-5.24
2002	13.14	-5.81	12.16	-4.36	14.92	-8.68
2002 PPS	13.26	-4.93	12.08	-5.02	15.00	-8.19

Table 5.2: Mean Length of Stay declined between 1999 and 2002 in almost all RICs and typically declined more in freestanding facilities than in units, although LOS within most RICs remains higher in freestanding facilities

	All IRFs			Units			Freestanding		
RIC	1999	2002	% Change	1999	2002	% Change	1999	2002	% Change
1	19.4	17.5	-9.8	17.7	16.3	-7.9	23.4	20.0	-14.6
2	18.8	15.9	-15.4	16.4	14.4	-12.0	23.3	18.4	-20.9
3	17.4	14.9	-14.6	15.7	13.7	-12.5	22.1	17.5	-20.8
4	22.8	19.9	-12.8	20.2	17.2	-15.0	27.2	24.4	-10.0
5	15.9	13.9	-13.1	14.7	12.9	-11.8	19.8	16.4	-17.0
6	16.3	14.3	-12.4	14.7	13.4	-9.2	19.4	16.2	-16.3
7	15.3	14.1	-7.4	13.7	13.1	-4.5	18.6	16.2	-12.9
8	10.6	9.5	-10.6	9.8	9.0	-8.7	12.4	10.5	-15.5
9	14.4	13.3	-8.0	13.0	11.7	-10.0	16.9	15.1	-10.9
10	17.0	15.4	-9.8	15.9	14.5	-8.7	19.8	17.1	-13.5
11	15.3	14.3	-6.7	14.0	12.7	-9.3	17.6	16.9	-4.0
12	14.3	12.4	-13.2	12.3	11.5	-6.3	16.2	14.4	-11.1
13	15.0	13.1	-12.4	13.0	11.9	-8.3	17.0	15.1	-10.9
14	13.6	12.3	-9.6	12.6	11.2	-11.3	15.5	13.6	-12.0
15	15.8	13.5	-14.6	13.7	11.9	-13.4	17.6	14.6	-16.9
16	13.7	11.7	-15.1	12.0	10.7	-10.5	16.1	12.9	-19.7
17	16.7	15.3	-8.4	15.3	14.0	-8.0	19.6	17.5	-11.0
18	20.4	18.8	-7.6	18.3	16.9	-7.9	24.9	21.0	-15.6
19	22.2	20.8	-6.0	21.2	19.3	-9.0	25.0	23.7	-5.5
20	14.8	13.4	-9.8	13.3	12.1	-8.9	17.8	15.1	-15.0
21	20.6	21.5	4.0	20.6	21.6	5.0	20.7	21.2	2.1
50	2.6	2.5	-4.6	2.6	2.5	-3.6	2.5	2.4	-7.0
51	14.7	12.5	-15.2	12.5	11.6	-7.0	17.2	13.9	-19.5
Total	15.1	13.1	-13.2	13.8	12.2	-11.6	17.7	14.9	-15.8

Note: Data for 1999 All IRFs column is based on a weighted estimate from the FIM sample.

Table 5.3: Comparison of volume, cost, and LOS for 1999 and 2002 for IRF population, by provider characteristics

	1999 data					2002 data					Percent change				
Hospital Group	Number of IRF	Number of cases	Avg. cost	Avg. LOS	Daily cost	Number of IRF	Number of cases	Avg. cost	Avg. LOS	Daily cost	Number of IRF	Number of cases	Avg. cost	Avg. LOS	Daily cost
All	1137	380513	10,929	15.07	725.37	1139	460669	10,868	13.13	827.67	0.2	21.1	-0.6	-12.9	14.1
Provider in both years?															
No	112	17662	12,633	15.72	803.60	114	28060	12,092	13.19	916.74	1.8	58.9	-4.3	-16.1	14.1
Yes	1025	362851	10,846	15.04	721.38	1025	432609	10,788	13.13	821.87	0.0	19.2	-0.5	-12.7	13.9
Area															
Urban	986	350267	10,903	15.14	720.20	968	420844	10,833	13.19	821.19	-1.8	20.1	-0.6	-12.9	14.0
Rural	151	30246	11,236	14.24	788.99	170	39410	11,280	12.41	908.61	12.6	30.3	0.4	-12.8	15.2
Type of Hospital															
Unit	935	253616	10,867	13.71	792.61	930	297919	11,132	12.15	916.30	-0.5	17.5	2.4	-11.4	15.6
Freestanding	202	126897	11,054	17.78	621.73	209	162750	10,384	14.93	695.65	3.5	28.3	-6.1	-16.0	11.9
Ownership															
Goverment	106	24642	12,073	14.83	814.01	113	33294	12,046	13.01	925.82	6.6	35.1	-0.2	-12.3	13.7
Non-profit	712	227541	10,856	14.03	773.66	696	264639	11,029	12.23	901.43	-2.2	16.3	1.6	-12.8	16.5
Proprietary	319	128330	10,839	16.95	639.56	330	162736	10,364	14.61	709.35	3.4	26.8	-4.4	-13.8	10.9
Unit of acute hospital															
ADC less than 10 pts.	299	35697	11,392	12.27	928.42	289	43308	11,495	10.88	1056.19	-3.3	21.3	0.9	-11.3	13.8
ADC 10-24 pts.	495	138392	10,513	13.42	783.28	504	164007	10,890	12.00	907.52	1.8	18.5	3.6	-10.6	15.9
ADC 25 or more pts.	141	79527	11,247	14.86	756.93	137	90604	11,397	13.02	875.04	-2.8	13.9	1.3	-12.3	15.6
Freestanding hospital															
ADC less than 25	53	9255	15,276	17.16	890.40	51	11318	13,579	13.91	976.07	-3.8	22.3	-11.1	-18.9	9.6
ADC 25-49	73	41308	10,412	17.48	595.59	73	47714	9,981	14.79	674.95	0.0	15.5	-4.1	-15.4	13.3
ADC 50 or higher	76	76334	10,889	18.02	604.43	85	103718	10,221	15.10	676.78	11.8	35.9	-6.1	-16.2	12.0
Census Region															
New England	40	17330	12,095	18.51	653.38	39	20763	12,085	15.80	764.87	-2.5	19.8	-0.1	-14.7	17.1
Middle Atlantic	148	70655	10,835	15.26	709.93	154	82111	10,628	12.91	823.08	4.1	16.2	-1.9	-15.4	15.9
South Atlantic	145	65798	10,325	14.72	701.29	140	77824	10,326	13.15	785.38	-3.4	18.3	0.0	-10.7	12.0
East North Central	218	63817	10,840	13.76	787.63	212	75102	10,870	11.98	907.60	-2.8	17.7	0.3	-13.0	15.2
East South Central	57	29096	10,053	15.84	634.74	63	34255	9,968	14.05	709.35	10.5	17.7	-0.8	-11.3	11.8
West North Central	100	23875	10,341	14.04	736.46	97	27366	10,788	12.57	858.54	-3.0	14.6	4.3	-10.5	16.6
West South Central	233	68932	11,258	15.90	707.90	238	90347	10,682	13.40	797.04	2.1	31.1	-5.1	-15.7	12.6
Mountain	75	18449	9,853	13.62	723.65	77	24956	10,204	12.60	810.04	2.7	35.3	3.6	-7.5	11.9
Pacific	121	22561	13,969	15.23	917.47	118	27530	14,663	13.79	1063.26	-2.5	22.0	5.0	-9.4	15.9
DSH Patient Ratio															
Less than .10	586	200252	10,186	14.34	710.14	581	242419	10,148	12.52	810.33	-0.9	21.1	-0.4	-12.7	14.1
.10-.19	361	125419	11,175	15.53	719.52	335	144193	11,128	13.74	809.74	-7.2	15.0	-0.4	-11.5	12.5
.20-.29	110	36395	12,418	16.08	772.12	104	42011	11,949	13.82	864.60	-5.5	15.4	-3.8	-14.1	12.0
.30 or higher	77	18192	14,350	17.68	811.65	66	20091	14,475	14.93	969.71	-14.3	10.4	0.9	-15.6	19.5
Missing	3	255	17,287	23.87	724.31	53	11955	12,466	12.62	987.72	1666.7	4588.2	-27.9	-47.1	36.4

Note: Table restricted to cases with case cost data.

Table 5.4: Comparison of LOS, percentage of costs for therapy, and average daily therapy cost for 1999 and 2002, by provider characteristics

	1999			2002			Percent change		
Hospital Group	avg. LOS	% of cost from therapy	average daily therapy cost	avg. LOS	% of cost from therapy	average daily therapy cost	avg. LOS	% of cost from therapy	average daily therapy cost
All	15.07	24.43%	176.83	13.13	23.17%	191.54	-12.9	-5.1	8.3
Provider in both									
No	15.72	23.28%	185.22	13.19	20.97%	192.13	-16.1	-9.9	3.7
Yes	15.04	24.49%	176.40	13.13	23.33%	191.50	-12.7	-4.7	8.6
Area									
Urban	15.14	24.35%	174.98	13.19	23.10%	189.38	-12.9	-5.1	8.2
Rural	14.24	25.28%	199.36	12.41	23.98%	217.89	-12.8	-5.2	9.3
Type of Hospital									
Unit	13.71	24.67%	195.10	12.15	23.72%	217.03	-11.4	-3.8	11.2
Freestanding	17.78	23.96%	148.93	14.93	22.11%	153.76	-16.0	-7.7	3.2
Ownership									
Goverment	14.83	24.07%	195.47	13.01	22.36%	207.03	-12.3	-7.1	5.9
Non-profit	14.03	24.41%	188.51	12.23	23.19%	208.71	-12.8	-5.0	10.7
Proprietary	16.95	24.54%	156.92	14.61	23.33%	165.47	-13.8	-4.9	5.5
Unit of acute hospital									
ADC less than 10 pts.	12.27	24.02%	222.47	10.88	22.05%	232.93	-11.3	-8.2	4.7
ADC 10-24 pts.	13.42	25.77%	201.93	12.00	24.63%	223.59	-10.6	-4.4	10.7
ADC 25 or more pts.	14.86	23.14%	173.89	13.02	22.95%	199.60	-12.3	-0.8	14.8
Freestanding									
ADC less than 25	17.16	24.31%	216.44	13.91	21.99%	214.39	-18.9	-9.5	-0.9
ADC 25-49	17.48	25.57%	152.29	14.79	22.28%	150.36	-15.4	-12.9	-1.3
ADC 50 or higher	18.02	23.06%	139.26	15.10	22.05%	149.24	-16.2	-4.4	7.2
Census Region									
New England	18.51	21.63%	141.35	15.80	19.65%	150.30	-14.7	-9.2	6.3
Middle Atlantic	15.26	20.97%	147.46	12.91	20.00%	163.37	-15.4	-4.6	10.8
South Atlantic	14.72	25.22%	176.76	13.15	24.04%	188.82	-10.7	-4.7	6.8
East North Central	13.76	25.12%	197.19	11.98	23.59%	214.12	-13.0	-6.1	8.6
East South Central	15.84	27.48%	173.72	14.05	25.92%	183.37	-11.3	-5.7	5.6
West North Central	14.04	26.33%	195.11	12.57	25.03%	214.92	-10.5	-4.9	10.2
West South Central	15.90	25.02%	177.12	13.40	24.23%	193.07	-15.7	-3.1	9.0
Mountain	13.62	24.61%	177.64	12.60	21.39%	173.29	-7.5	-13.1	-2.5
Pacific	15.23	25.25%	231.70	13.79	24.50%	260.45	-9.4	-3.0	12.4
DSH Patient Ratio									
Less than .10	14.34	25.00%	177.58	12.52	23.47%	190.16	-12.7	-6.1	7.1
.10-.19	15.53	24.21%	173.42	13.74	22.87%	184.34	-11.5	-5.5	6.3
.20-.29	16.08	23.49%	180.43	13.82	23.74%	205.22	-14.1	1.1	13.7
.30 or higher	17.68	22.85%	185.94	14.93	22.44%	217.64	-15.6	-1.8	17.0
Missing	23.87	14.20%	102.85	12.62	21.11%	208.52	-47.1	48.7	102.7

Note: Sample is same as Table 5.3, except this table omits
all cases from IRFs that charged for therapy for fewer than 67 % of cases.
This restriction omitted 13 hospitals with 4460 cases in 1999 and 4 hospitals with 1730 cases in 2002.

Table 5.5: PPS Payment, average case weight, cost and payment to cost ratios for all 2002 cases, by hospital characteristics

Category	N Facilities	N Cases	N Equivalent Cases	Average Total Fed Pay	Average Case Weight	Average Bundled Cost	Average Standardized Cost	Payment to Cost Ratio
All facilities	1072	415169	386520	$12,559	0.97	$10,790	$10,622	1.16
Geographical Area								
Urban	903	375184	349192	$12,573	0.98	$10,776	$10,604	1.17
Rural	169	39985	37328	$12,433	0.95	$10,930	$10,790	1.14
Census Region								
New England	37	19494	18130	$14,277	1.03	$11,916	$10,133	1.20
Middle Atlantic	150	77225	71996	$12,577	0.91	$10,541	$10,369	1.19
South Atlantic	140	72125	67548	$12,445	0.99	$10,267	$10,132	1.21
East North Central	182	62207	56597	$12,018	0.95	$10,723	$10,789	1.12
East South Central	63	31435	29293	$12,316	1.03	$9,964	$9,991	1.24
West North Central	97	25384	23414	$11,607	0.95	$10,849	$11,495	1.07
West South Central	230	82076	77219	$11,895	0.98	$10,632	$11,159	1.12
Mountain	63	20573	19167	$12,199	0.97	$10,031	$10,198	1.22
Pacific	110	24650	22782	$16,648	1.06	$14,542	$11,298	1.14
Type of Hospital								
Freestanding	201	154503	143764	$12,946	1.03	$10,266	$9,612	1.26
Unit	871	260666	242755	$12,330	0.94	$11,101	$11,221	1.11
Ownership								
Non-Profit	678	243523	226375	$12,296	0.94	$10,991	$11,018	1.12
Proprietary	277	138634	129243	$12,978	1.03	$10,190	$9,713	1.27
Government	117	33012	30901	$12,740	0.97	$11,831	$11,526	1.08
Unit of acute hospital								
ADC less than 10 pts.	297	42647	39653	$11,542	0.90	$11,409	$12,139	1.01
ADC 10-24 pts.	447	136634	127191	$12,265	0.94	$10,879	$11,082	1.13
ADC 25 or more pts.	127	81385	75912	$12,853	0.96	$11,312	$10,973	1.14
Freestanding hospital								
ADC less than 25	46	9762	9073	$12,492	0.97	$13,201	$13,200	0.95
ADC 25-49	72	46952	43547	$12,759	1.04	$9,911	$9,435	1.29
ADC 50 or higher	83	97789	91145	$13,080	1.04	$10,143	$9,339	1.29
DSH Patient Ratio								
Less than .10	573	239079	222922	$11,860	0.95	$10,080	$10,428	1.18
.10-.19	327	127383	118766	$12,907	1.00	$11,230	$10,772	1.15
.20-.29	101	32097	29637	$14,369	1.00	$12,524	$11,312	1.15
.30 or higher	71	16610	15194	$16,461	1.06	$14,289	$10,952	1.15
CMI Quartiles								
Quartile 1	268	93615	87675	$10,492	0.80	$9,454	$10,219	1.11
Quartile 2	268	96844	90262	$11,912	0.92	$10,722	$10,813	1.11
Quartile 3	268	116107	108176	$12,632	1.01	$10,649	$10,769	1.19
Quartile 4	268	108603	100407	$14,841	1.13	$12,155	$10,692	1.22
Residents to ADC ratio								
Non-teaching	961	368195	343066	$12,411	0.98	$10,579	$10,539	1.17
Less than .10	58	28429	26302	$13,539	0.97	$11,716	$10,719	1.16
.10-.19	34	14442	13390	$13,678	0.93	$13,316	$12,148	1.03
.20 or higher	19	4103	3761	$15,167	1.02	$14,419	$12,126	1.05

Table 5.6: Average standardized cost in 2002 was highly correlated across tier and RIC with case weight and federal payment, but variations in the payment to cost ratio show the need to refine the CMGs and tiers'

Category	N Cases	N Equivalent Cases	Average Total Fed Pay	Average Case Weight	Average Bundled Cost	Average Standardized Cost	Payment to Cost Ratio
All Cases	415169	386520	$12,559	0.97	$10,790	$10,622	1.16
Comorbidity Tier							
None	311562	292824	$11,666	0.91	$10,156	$10,672	1.15
1	7385	6471	$19,266	1.45	$15,480	$10,225	1.24
2	36832	33118	$15,902	1.21	$13,469	$10,432	1.18
3	59390	54106	$14,339	1.11	$11,876	$10,514	1.21
RIC							
1	71191	63905	$17,395	1.34	$14,827	$10,843	1.17
2	5289	4646	$16,150	1.23	$13,557	$10,833	1.19
3	8288	7382	$16,383	1.22	$13,390	$10,846	1.22
4	2128	1863	$20,598	1.51	$17,709	$11,091	1.16
5	13728	12686	$14,328	1.09	$11,961	$10,920	1.20
6	18333	17011	$13,777	1.04	$11,851	$10,664	1.16
7	49731	45927	$12,724	1.00	$11,179	$10,622	1.14
8	94285	92228	$8,737	0.69	$7,697	$10,590	1.14
9	19702	18478	$11,616	0.92	$9,783	$10,299	1.19
10	10688	9729	$15,293	1.17	$13,255	$10,776	1.15
11	1091	988	$14,115	1.05	$12,113	$10,461	1.17
12	9557	9017	$10,833	0.86	$9,952	$11,152	1.09
13	4264	4002	$12,268	0.94	$10,576	$10,761	1.16
14	22850	20828	$11,505	0.89	$9,734	$10,347	1.18
15	9591	8722	$13,234	1.01	$10,876	$10,147	1.22
16	9070	8594	$10,428	0.82	$9,099	$10,561	1.15
17	4501	4122	$14,440	1.12	$12,275	$10,699	1.18
18	800	707	$20,413	1.54	$15,920	$10,452	1.28
19	530	477	$21,819	1.65	$17,866	$10,991	1.22
20	49386	45055	$12,755	0.99	$10,740	$10,409	1.19
21	196	183	$25,852	1.53	$25,326	$11,550	1.02
50	9060	9060	$2,034	0.17	$2,239	$10,589	0.91
51	910	910	$11,830	0.81	$11,701	$10,506	1.01

Appendix 2

Effects of Payment Changes on Trends in Access to Post-Acute Care

Completed Under Contract DRR-3324-CMS

This report was prepared under contract with RAND Corporation by Melinda Beeukes Buntin , Jose Escarce, Carrie Hoverman, Susan M. Paddock, Mark Totten and Barbara Wynn.

Preface

Since the inception of the Inpatient Rehabilitation Facility Prospective Payment System (IRF PPS) in 2002, RAND has been contracted by the Centers for Medicare and Medicaid Services (CMS) to support its efforts to monitor the effect of the IRF PPS. To date, RAND has provided a number of analyses and reports on patient access to and utilization of IRF services before and after the implementation of the IRF PPS. Our reports address the Congressional mandate for a study of IRF patient access to care.

This report focuses specifically on how the implementation of new Medicare post-acute payment systems has affected the use of inpatient rehabilitation facilities, skilled nursing facilities, and home health care. This report was prepared for CMS, but should also be of interest to individuals in the health care and policy-making arenas who are concerned about Medicare beneficiaries' access to care.

This work was sponsored by CMS under contract 500-2004-00033c and carried out under the auspices of RAND Health, a unit of the RAND Corporation. Comments or inquiries should be sent to the first author of this report, Melinda Beeuwkes Buntin (Buntin@rand.org). We would like to thank the IRF PPS project team including Grace Carter, Regina Hollins, Dan Relles, Debra Saliba, and Neeraj Sood and CMS staff Philip Cotterill, Susanne Seagrave, and Jeannette Kranacs for helpful comments. For more information about RAND Health, please visit <http://www.rand.org/health/>. The mailing address is RAND Corporation, 1776 Main Street, Santa Monica, CA 90407-2138. More information about RAND is available at http://www.rand.org.

CONTENTS

Preface.....i
Tables and Charts.....iii
Acronyms.....iv
Executive Summary.....v
Introduction.....1
Background.....2
Conceptual Framework.....6
Hypotheses.....7
Data and Methods.....8
Statistical Analysis.....13
Results.....14
Conclusions.....17
References.....19

TABLES AND CHARTS

Table 1: First Location of Post-Acute Care Within 30 Days of Discharge.....23
Chart 1: Medicare Spending on PAC by Setting.....24
Chart 2: Unadjusted PAC Use, Hip Fracture Patients.....25
Chart 3: Unadjusted PAC Use, Stroke Patients.....26
Chart 4: Unadjusted PAC Use, Joint Replacement Patients.....27
Chart 5: Unadjusted PAC Use, Congestive Heart Failure Patients.....28
Table 2: Means of Characteristics.....29
Table 3a: Multinomial Regressions, First PAC Site, Hip Fracture Patients.....30
Table 3b: Multinomial Regression, First PAC Site, Stroke Patients 1996 to 2003.....31
Table 3c: Multinomial Regression, First PAC Site, Joint Replacement Patients.....32
Chart 6: Predicted Probabilities of Hip Fracture Patients going to each PAC Location.....33
Chart 7: Predicted Probabilities of Stroke Patients going to each PAC Location.....34
Chart 8: Predicted Probabilities of Joint Replacement Patients going to each PAC Location...35
Appendix 1: Outpatient Therapy.....36

Acronyms

ADC	Average daily census
AMI	Acute myocardial infarction
BBA	Balanced Budget Act of 1997
BBRA	Balanced Budget Refinement Act of 1999
BIPA	The Benefits Improvement and Protection Act
CMS	Centers for Medicare and Medicaid Services
DRG	Diagnosis-related group
HHA	Home health agency
HHC	Home health care
IRF	Inpatient rehabilitation facility
IPS	Interim payment system
LTCH	Long-term care hospital
MSA	Metropolitan statistical area
PAC	Post-acute care
RUG	Resource utilization group
SNF	Skilled nursing facility
PPS	Prospective payment system
TEFRA	Tax Equity and Fiscal Responsibility Act

Executive Summary

In 1997, Congress mandated the development and implementation of prospective payment systems for post-acute care (PAC PPSs). Its goal was to introduce incentives for efficiency and reduce spending. However, some worried that PAC providers would respond in ways that would reduce beneficiary access to care. This concern was particularly acute for more severely ill patients who may be less profitable than typical patients under these systems. In addition, there were concerns that the PAC PPSs would cause shifts in the burden of care across sites.

This report represents one of the first efforts to examine the cumulative effect of these payment changes on patient access to care. The post-acute payment system changes we study are the Home Health Agency Interim Payment System (HHA IPS), the Skilled Nursing Facility Prospective Payment System (SNF PPS), Home Health Agency Prospective Payment System (HHA PPS), and the Inpatient Rehabilitation Facility Prospective Payment System (IRF PPS). We examine "realized access" to care by measuring utilization of Medicare-paid IRFs, SNFs, and HHA care, and how it has changed in response these prospective payment systems enacted in the late 1990s and early 2000s. For each payment system we look at both the immediate effects of the payment system on the use of the site of care it affected directly, and the longer-term effects of the payment system. In order to account for potential substitution across sites, we also look at the effects of payment system changes on alternative sites of care. Finally, we consider the question of whether more severely ill patients have seen their access to care decline more than other patients as a result of these changes.

The study focuses on elderly Medicare patients discharged from acute care facilities between 1996 and 2003 with a diagnosis of hip fracture, stroke, or lower extremity joint replacement. Models are used to predict the probability of patients going to a post-acute care location (no Medicare post-acute care, IRF, SNF, or HHC) before and after each payment system was enacted, controlling for underlying trends in PAC use, patient characteristics, and discharging hospital characteristics. We assess the importance of the payment system changes in the choice of PAC site by simulating how much each payment system changed the predicted probabilities of using IRF care, SNF care, and HHC.

Our results are displayed in the summary table below. We find that although the effects of the payment systems on the use of PAC varied, most reduced the use of the site of care they directly affected and boosted the use of other sites of care. However, since these payments systems were implemented nationally, we are limited to an uncontrolled pre/post analysis and cannot draw strong conclusions about the causal effects of payment changes. There was a marked decline in the use of home health care with the implementation of the HHA IPS, which persisted in the period following its implementation for stroke and joint replacement patients. Similarly, the implementation of the SNF PPS was associated with a significant decline in SNF use for hip fracture and joint replacement patients and an increase in HHC use over time for all three conditions. As anticipated, use of HHC decreased with the implementation of the HHA PPS for all three conditions. In the period after the HHA PPS implementation there was an increase in use of SNF care for stroke patients. The IRF PPS was associated with greater SNF and IRF use for joint replacement patients. In the period following the IRF PPS, there is evidence of a trend away from SNF use for hip fracture patients.

We also ran a model that included interactions for more severely ill patients with the payment system variables to see if they were differentially affected by the changes in payment systems giving facilities incentives to constrain costs and avoid unprofitably expensive patients. Including these 10 interaction variables across three PAC location choices resulted in only a few weakly significant effects so these payment system changes do not, appear to have affected the severely ill more than others. This may be because many of the new payment systems during this time were case mix adjusted, while the prior payments were cost-based with per-beneficiary limits.While this is good news, continued attention should be given to this issue in the future. In addition, it is also interesting to note that the changes described above were least significant and pronounced for hip fracture patients and most pronounced for stroke patients. This is a cause for concern because stroke patients are the group for whom there is the most evidence that aggressive post-acute rehabilitation produces better outcomes.

Overall, most of the payment system changes that were intended to contain costs had the effect of decreasing the use of the site of care directly affected. But in many cases they also had the effect of increasing the use of alternative care sites. These changes do not, however, appear to have affected the severely ill more than others.

Introduction

Post-acute care (PAC) was the fastest growing category of Medicare spending from the early 1990s until the Balanced Budget Act of 1997 and subsequent Balanced Budget Refinement Act of 1999. These Acts of Congress altered Medicare's PAC payment policies dramatically, shifting reimbursements for providers from a cost basis to prospective payment systems (PPSs). The PAC PPSs were designed to introduce incentives for efficiency and to reduce spending, but there are concerns that PAC providers and facilities have, and will, respond to them in ways that negatively affect beneficiary access to appropriate care. In addition, there are concerns that the PAC PPSs could cause shifts in the burden of care across sites.

Early evidence suggests that the payment changes are constraining use and containing overall costs without changing gross patient outcomes (McCall et al. 2003; MedPAC 2003). However, policymakers remain concerned that the payment changes are causing shifts in sites of care that could harm patients. The need to monitor access to PAC care generally, and Inpatient Rehabilitation Facility (IRF) care specifically, has been voiced many times. It was emphasized in CMS' final rule for the IRF PPS, and more recently in a special issue of the Milbank Quarterly on disability issues (Dejong et al. 2002). Dejong et al. specifically pointed to the need to monitor the volume of care delivered in each PAC setting and the need to monitor access to care after acute discharge. MedPAC reports have also called for the monitoring of PAC use across sites and for multivariate analyses of PAC use and trends (March 2002, p.23; March 2003, p.93, 113; March 2004, p. 141). These concerns are compounded by a general lack of clinical consensus about what types of PAC are appropriate for which patients, which may leave patients particularly exposed to financial pressures (Jette and Keysor 2002).

In this report we address these concerns by investigating the effects of all of the major changes in post-acute care payment systems on patients' use of care. We do so looking at all patients discharged from acute care with selected conditions, over a long period of time (1996 through 2003), and using multivariate models that control for changes in case-mix and other factors. We also examine the effects of payment changes on more versus less severely ill patients to see if patients expected to be more costly are differentially affected by the payment changes.

Background

The goal of post-acute care is to restore recently hospitalized patients to their prior level of functioning. It is also used to improve the transition from hospital to the community; post-acute care facilities provide services to patients needing additional support to assist them to recuperate following discharge from an acute hospital.

Patients can access PAC services in many settings including skilled nursing facilities (SNFs), inpatient rehabilitation facilities (IRFs) and patients' homes with services from home health agencies (HHAs).[1] Each of these settings offers a different level of care. IRFs provide intensive rehabilitation (three or more hours a day of therapy) in an inpatient setting. SNFs can also provide inpatient rehabilitation under the Medicare benefit, although it is generally less intensive than that provided in an IRF (Gage 1999). Home health care agencies provide therapy, nursing care, and assistance from home health aides.[2]

Interest in post-acute care has risen with the marked increase in its use following the implementation of the acute hospital PPS. Between 1988 and 1997, Medicare spending for post-acute care services increased at an average annual rate of 25 percent (MedPAC 2003). Chart 1 shows the trends in total Medicare spending on post-acute care over time, and spending by post-acute care setting as a percentage of total Medicare spending. This increase was due to both a shift to PAC as a way to reduce length of stay after the acute care prospective payment system was put in place, as well as class-action lawsuits which liberalized the definitions of eligibility for service provision and coverage (*Fox v. Bowen* 1986 and *Duggan v. Bowen* 1988) (McCall et al. 2003; Chan 1997; Manton 1993; Steiner and Neu 1993; Neu et al. 1989; Lewis 1987).

Medicare beneficiaries frequently use post-acute care: 40 percent of beneficiaries used post-acute care following hospital discharge in 1996, in 2001 the number was down slightly but PAC was still used by a third of hospitalized beneficiaries. Total Medicare spending on PAC in 1996 was $35.7 billion, up from $14 billion in 1994. After myriad reforms in the post-acute care payment systems, this figure declined in 1999 due to reductions in home health use but reached $30.6 billion in 2001 and is on the rise again. Post-acute care currently makes up about 12 percent of Medicare's total spending (MedPAC 2003). Given the amount of money spent on

[1] Services provided in long-term care hospitals, outpatient departments, clinics, or physicians' offices could also be considered post-acute care under some circumstances. Custodial care provided in nursing homes can be provided to patients when they leave the hospital, but it is generally considered long-term care rather than post-acute care.

[2] A distinction is usually made between home health care that occurs post-hospitalization and that which is "community-referral." Here we do not examine home health use that is not preceded by an acute discharge.

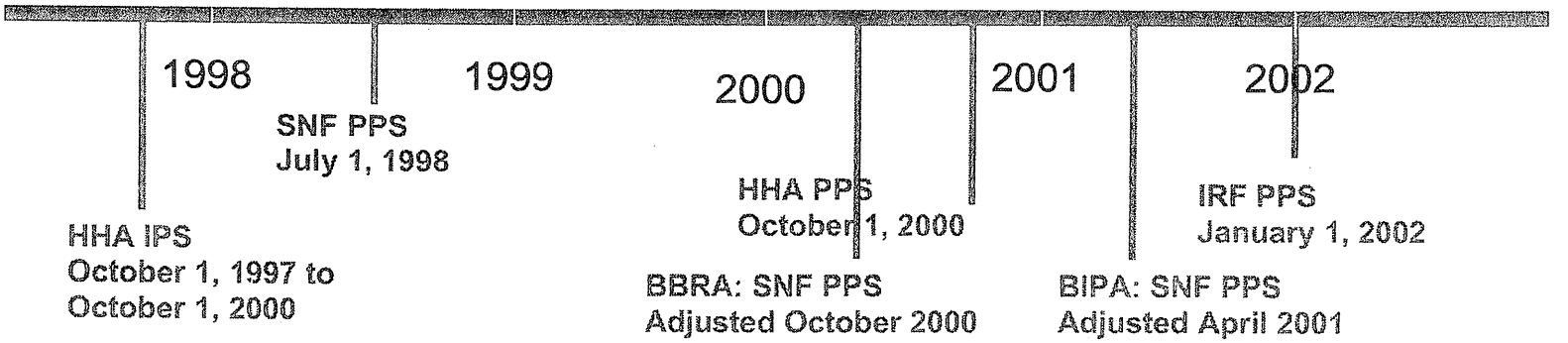
post-acute care, it is important to understand access to and use of this benefit, and how it has responded to recent payment system changes.

Payment System Changes

As prospective payment systems are implemented in post-acute care settings, they are altering trends in use. The amount of services provided by each facility type has responded to changes in the payment systems (Street et al. 2003; McCall et al. 2003; White 2003; Cotterill and Gage 2002). The BBA of 1997 immediately put in place an interim payment system (IPS) for home health services which limited reimbursement by both reducing the per-visit cost limits in place and adding an aggregate per-beneficiary payment limit (McCall et al. 2003). In July 1998 the SNF prospective payment system was the first permanent post-acute care PPS implemented (Cotterill and Gage 2002). Previously, SNFs had received per-diem payments plus reimbursement for ancillary services including rehabilitation therapy. Under the PPS, SNFs are paid on an all-inclusive per diem basis. The prior payment system (under TEFRA) was based on cost, while the new payment system is prospective and case-mix adjusted. SNF PPS payment rates were intended to achieve substantial budgetary savings.

The prospective payment systems for home health services and inpatient rehabilitation facilities have been in place since October 1, 2000 and January 1, 2002, respectively. Under the home health PPS, HHAs are paid for 60-day episodes. The HHA PPS was designed to be budget neutral to the HHA IPS until October 2002 when it was subject to a 15 percent reduction in the per beneficiary spending limits. The IRF PPS was also designed to be budget neutral, and one of its goals was to compensate IRFs fairly for more severely ill patients. Previously, facility payments were based on historical cost per discharge, and were not adjusted for case mix. Under the IRF PPS, facilities are paid an adjusted amount per discharge. The amount is adjusted based on case mix and facility characteristics. The timeline below shows when each of these payments systems was implemented and the BBRA and BIPA implementations, which represented major adjustments.[3]

[3]The long-term care hospital PPS was implemented October 1, 2002. The effects of the LTCH PPS are not addressed here.



Trends in the Use of Post-Acute Care

Medicare spending for PAC services in aggregate declined by almost 10 percent between 1996 and 2001, due primarily to a nearly 50 percent decline in spending for home health services following the BBA. Over the same time period, the total number of beneficiaries using PAC decreased by 18 percent, from 4.3 to 3.5 million users (MedPAC 2003). However, use of all post-acute care other than home health care increased between 1996 and 2001. Between 1996 and 2001, aggregate payments for SNF services increased by 37 percent and aggregate payments for IRF services increased by 20 percent (MedPAC 2003). Total Medicare spending for SNF services in fiscal year 2002 was $14.5 billion, about 5.6 percent of total Medicare spending for all services (MedPAC 2004). Another interesting trend during this period was a significant increase in the proportion of users 85 years and older who used PAC. Other demographic characteristics remained relatively constant between 1996 and 2001 (MedPAC 2003).

The effects of prospective payment on different types of patients and on the care provided once PAC is accessed has been the focus of prior research. Angelelli et al. (2002) observed a small decrease in the proportion of the costliest patients admitted to SNFs in 1999 in Ohio compared with pre-BBA years, a decrease in home health care use, and no changes in rehospitalization rates for the costliest patient types. McCall et al. (2003) observed that changes in treatment patterns included more beneficiaries receiving no post-acute care, much less use of home health services both initially and after institutional post-acute care, and slightly more use of rehabilitation and long-term care hospitals. However, no consistent increases in adverse outcomes were observed. MedPAC (2004) has also been focusing on access to care and found that while the majority of beneficiaries appear to have little or no delay in accessing SNF services, beneficiaries needing certain types of complex care or special services (for example, IV therapy, dialysis, specialized beds, expensive prescription drugs, or specialized feeding) may

experience delays of a few days, weeks, or longer in accessing these services. MedPAC (2004) also found that nearly 90 percent of the beneficiaries surveyed about their experiences in 2000 reported that they had little or no problem with accessing home health services. MedPAC plans to continue to monitor access to HHC and financial incentives to provide care to the most complex patients.

Regarding the level of care received, White (2003) observed that following the implementation of the SNF PPS, SNF residents were more likely to receive moderate levels of rehabilitation and less likely to receive either no rehabilitation or an extremely high level of rehabilitation. White also observed that freestanding and hospital-based SNFs responded differently to the PPS. For-profit freestanding SNFs reduced average rehabilitation charges per resident by 47 percent between 1997 and 2000 while non-profit freestanding SNFs reduced average rehabilitation charges by 23 percent. Hospital-based SNFs slightly increased rehabilitation charges per resident per day over this period. Yip et al. (2002) found that patients admitted to three SNFs in southern California after PPS implementation were more likely to have orthopedic problems or stroke and poorer self-reported physical health. They had significantly shorter lengths of stay in rehabilitation and received significantly less therapy.

Examining changes before and after the implementation of prospective payment for SNFs and HHC, MedPAC found substantial declines in the use of HHC, and increases in use of SNFs and other PAC providers. This indicates some practical "substitutability" between post-acute care settings. There is little to indicate that these settings necessarily produce the same outcomes, but in practice there is evidence of one setting being used instead of another. This may be due to changes in patterns of medical care that have led to substantial overlap in the types of services furnished by different Medicare-recognized acute and post-acute care providers (Young 1997). For some diagnoses, MedPAC observed that SNF use in 2001 may be partly replacing home health services. For example, for septicemia discharges (DRG 416), home health use declined from 21 to 10 percent, while SNF use increased from 21 to 27 percent (MedPAC 2003). Cotterill and Gage (2002) suggested that some portion of the increase in utilization of IRF services between 1997-1998 and 2000 may have been influenced by implementation of the SNF PPS and HHA IPS at that time. The staggered PPS implementation dates may have caused variation in fiscal pressures across settings over time and shifts in sites of care (Bronskill 2002; Cotterill and Gage 2002). Clearly, there has been a surge in research regarding post-acute care,

but there remains a gap in the literature on the cumulative effects of the PAC payment system changes (McCall et al. 2003; White 2003; Angelelli et al. 2002; Komisar 2002; Stineman 2002; Yip et al. 2002).

Conceptual Framework

Our goal is to measure access to PAC and how it changed with the implementation of Medicare's new payment systems. Access to care is a measure of the quality of the care process, is a precursor to good quality of care, and is valued as a positive outcome in its own right. Access is usually defined in terms of adequate availability of care, timeliness of care use, and use of needed services (IOM 1993). In this report, we examine "realized access" as represented by utilization of post-acute care (Andersen et al. 1983; Lurie, 2002).

The evidence suggests that different payment changes may have different effects depending on their magnitude, timing, and design. We examine changes in realized access to post acute care following the five major payment system changes that took place during the 1996 to 2003 period. The post-acute payment system changes we study are the HHA Interim Payment System (1997), the SNF Prospective Payment System (1998), HHA Prospective Payment System (2000), and the IRF Prospective Payment System (2002). We also look at the Balanced Budget Refinement Act and the Benefits Improvement and Protection Act, which boosted SNF payment rates in 2000 and 2001 respectively. For each payment system we look at both the immediate effects of the payment system on the use of the site of care it affected directly, and on the longer-term effects of the payment system since changes may unfold as providers learn about and adapt to the system. Given the potential for substitution across sites, we also look at the effects of payment system changes on alternative sites of care. As described above, the payment systems varied markedly in their design. They used different units of payment: the SNF PPS per diem encourages providers to limit their expenditures per day, but does not provide an incentive to limit length of stay. The HHA PPS provides an incentive to limit expenditures per episode and the IRF PPS pays per discharge. Also, some had provisions aimed at controlling costs more aggressively than others. The AHA projected that the HHA IPS would save $3.1 billion in 1998 and 1999 and in the final rule CMS estimated that the SNF PPS would save $30 million in 1998 (AHA 1998). In contrast, the IRF PPS was designed to be budget neutral. Nonetheless, all of the prospective payment systems share the feature that providers who deliver care that costs less than the case payment, or serve patients who are less costly than the average patient in their

payment group, can keep the difference as profit. Ellis and McGuire (1996) discuss this range of actions that providers can take in response to the implementation of prospective payment: the one we examine here is *selection* behavior. Providers engaging in selection change their admission policies so as to restrict access for patients not likely to be profitable. In order to examine whether there is evidence of selection behavior we create a composite measure of patient severity and examine whether trends in care use for these more severe patients differed from those of less severe patients.

Finally, in order to model the changes in PAC use and to relate them correctly to payment system changes versus changes due to other factors, it is important to understand the determinants of PAC use. Researchers have found a number of patient-level, provider-specific, and area factors affect the use of PAC and choice of post-acute care sites. Individual demographic and clinical characteristics are important determinants of PAC use. Factors including age, gender, race, marital status, functional status, history of disability, medical condition, and comorbidities influence the sites to which patients are discharged (Neu et al. 1989; Manton et al. 1993; Steiner and Neu 1993; Kane et al. 1996; Lee et al. 1997; Liu et al. 1998; Gage 1999; Bronskill et al. 2002; Finlayson 2002; Shatto 2002; MedPAC 2003; Beeuwkes Buntin et al. forthcoming 2005). Factors beyond patient characteristics also influence use of post-acute care. These include facility-level predictors such as the volume of Medicare patients served, hospital size, and status as a teaching hospital (Blewett et al. 1995; Neu et al. 1989; Steiner and Neu 1993; Bronskill et al. 2002). We incorporate measures of these factors into our analyses to control for these effects. PAC supply characteristics play a key role in PAC use as well (Neu et al. 1989; Swan and Benjamin 1990; Kenney and Dubay 1992; Dubay 1993; Steiner and Neu 1993; Young 1997; Liu et al. 1998; MedPAC 2003). However, since these effects can themselves be altered by payment system changes we do not include them in our models as developing models to account for endogenous effects of this type was beyond the scope of this project.

Hypotheses

The theoretical and observed effects of prospective payment and the goals of the different payment systems led us to the guiding hypotheses listed below.

- The immediate effects of the HHA IPS and SNF PPS, which were intended to constrain cost growth, will be to reduce the use of HHA and SNF, respectively. The HHA IPS limited payments through per beneficiary limits, while the SNF PPS payments were initially considered less generous than TEFRA payments because they did not reimburse for the actual cost of providing care. Both were projected to produce large savings as described above. Reductions in use will differentially affect more severely ill patients. In addition, over time, the HHA and SNF payment systems will be associated with greater use of alternative sites of PAC (i.e. in the case of the HHA IPS with greater use of IRF and SNF care.)[4,5]
- The HHA PPS will be associated with a negative effect on use of HHC, but may increase use of HHC by severely ill patients since the HHA payments were previously not case-mix adjusted. We expect the HHA PPS might also have a negative effect over time on HHC use since CMS introduced further cuts in payments in 2002. In addition, over time, the HHA PPS will be associated with greater use of alternative sites of PAC.
- The IRF PPS, which was designed to be budget neutral, will have little effect on the use of IRF care overall. It might increase use for more severely ill patients since the lack of a case mix adjustment under the prior reimbursement system (TEFRA) could have limited access, and older facilities had been locked into low TEFRA base payments.

Below we describe the data and methods used to explore these hypotheses. Before doing that, however, it is important to note that since these payments systems were implemented nationally, we are limited to an uncontrolled pre/post analysis. Our data and methods thus only allow us to look at associations between payment changes and changes in realized access. In other words, we are not able to draw strong conclusions about the causal effects of payment changes on care use.

Data and Methods

Sample Studied

[4] Facilities with higher costs prior to the implementation of the PPSs would also be expected to respond more strongly to the new incentives. Unfortunately, examining this hypothesis was beyond the scope of this report.

[5] These hypotheses imply additional corollary effects. The hypothesized initial declines in the use of site HHA and SNF care when their payment changes are implemented are expected to shift patients from that setting to others – but primarily to no formal PAC in the short term. The hypothesis that over time alternate sites of care will be used more frequently could then be manifest through further reductions in the site of care directly affected or by patients shifting out of the no formal PAC category.

We have complete data on all elderly Medicare patients discharged from hospitals between January 1996 and June 2003. Within this group we chose to focus on the largest patient groups using all types of PAC: stroke patients, hip fracture patients, and lower extremity joint replacement patients. These conditions account for approximately 7 percent of Medicare acute discharges and one quarter of discharges to PAC. Hip fracture was defined using a principal inpatient diagnosis of "fractures of the neck of the femur" (diagnosis codes 820.xx). Hip fracture patients who were listed as having metastases to the bone or who suffered major trauma to a site other than a lower extremity were excluded from the sample so as to create a clinically uniform group of patients. Stroke was defined as intracerebral hemorrhage (431.xx), occlusion and sterosis of precerebral arteries with infarction (433.x1), occlusion of cerebral arteries with infarction (434.x1), and acute but ill-defined cerebrovascular disease (436.xx). Joint replacement was defined using the DRGs for joint replacement procedures (209, 471) minus those patients classified above as hip fracture and minus those with reattachment procedures 84.26, 84.27 and 84.28. (During our base period, the fraction of hip fracture patients receiving a replacement during their initial acute hospitalization increased.) We also examine one medical condition in less detail: congestive heart failure (428.xx). Congestive heart failure was judged by project clinicians to be the most clinically uniform medical cause of admission to acute care that has a reasonable number of patients subsequently admitted to IRF care (approximately 5,000 patients per year).

Measures

Our dependent variable was the first post-acute care site used after discharge from an acute care hospital. We chose to use the first site because a majority of acute discharges use only one site in their post-acute care episode. Seventy-two percent of our tracer condition population used only one site of care, while 93 percent of all acute discharges use only one site of care. We considered post-acute care use to be IRF use, SNF use, or HHC that began within 30 days of discharge from acute care and was covered by Medicare.[6] We grouped care delivered in swing

[6] We defined acute care hospitals using Medicare provider numbers. However, we dropped acute admissions that took place outside of the 50 states plus the District of Columbia and admissions to children's hospitals and psychiatric hospitals and units. We counted critical access hospitals (rural primary care hospitals) as acute care hospitals (provider numbers 1300 to 1399). We also excluded all patients residing in or receiving acute care in the state of Maryland as that state has its own hospital prospective payment system that makes it impossible to distinguish admissions to IRF facilities from acute admissions. In addition, care delivered in long term care hospitals (LTCHs) often qualifies as institutional PAC as well. We do not analyze LTCHs here, however, since there are relatively few of them. Less than 0.05 percent of Medicare patients discharged from acute care use these

beds with SNF care. We also constructed files that contain data on patients receiving care in long-term care hospitals (LTCHs) for all years, under DRG 462 (rehabilitation) in acute settings for all years, and outpatient settings in 1999 and 2003. After examining the low level of use of LTCHs, outpatient therapy, and DRG 462, we drop them from further analysis. Each of these types of care was defined using Medicare provider numbers and/or claim types.

Patients who were readmitted to the hospital during the 30-day window were kept in the sample but acute care was not counted as a PAC site. Although Medicare rules allow SNF patients to delay entry for more than 30 days after their acute discharge (in order to gain enough strength to undertake rehabilitation) this did not greatly affect our analyses: 97.3 percent of SNF patients in our sample began SNF care within 30 days of discharge if they used it at all. Patients who died in the hospital or within 30 days of discharge were dropped from the sample because they were unlikely to be considered good candidates for rehabilitation. This excluded population was small – 6 percent for hip replacement deaths, 10 percent for stroke deaths, and less than 1 percent of joint replacement patients died within 30 days.[7]

We assembled, and included as independent variables in our models, a wide array of clinical, individual, and discharging hospital characteristics that might affect PAC choices.

Individual Predictors. We identified a number of patient-level characteristics hypothesized to affect use of PAC care and type of PAC used. To allow for non-linear effects of age on PAC use in our models we classified patients into 3-year age bands. We also included gender, race and place of residence (defined as a MSA, an area adjacent to a MSA, or rural area/not adjacent to an MSA) in our analyses. All of these patient-level predictors were created using fields on the inpatient claims. In addition, we used the Medicare Denominator file to create indicators for whether patients were receiving Medicaid at the time of their acute admission or within 4 months of discharge. (Those who went on Medicaid soon after discharge were presumed to have been income-eligible for coverage, but not yet enrolled.)

Clinical Predictors. To capture the complexity of patients at the time of hospital discharge we included a large set of comorbidities and complications tailored to our stroke, hip fracture, and joint replacement patients. These were derived from diagnoses on the hospital discharge

---

facilities, and the facilities do not all provide post-acute care. A few LTCHs, for example, serve a primarily psychiatric population (Liu et al. 2001).

[7] While this population is small, it could be argued that they are a key group of seriously ill patients. However, the data suggests that they are not good candidates for PAC as their rates of PAC use are considerably lower than those of the Medicare population as a whole over the time period examined.

records. The comorbidities used in our analyses were the chronic conditions identified by Iezzoni et al. (1994) as conditions that are nearly always present prior to hospital admission and hence are extremely unlikely to represent complications arising during the hospitalization. These conditions included primary cancer with poor prognosis, metastatic cancer, chronic pulmonary disease, coronary artery disease, congestive heart failure, peripheral vascular disease, severe chronic liver disease, diabetes mellitus with and without end-organ damage, chronic renal failure, nutritional deficiencies, dementia, and functional impairment.

The second type of case mix variable was complications that were likely to have arisen during the hospital. To develop this list, we adapted the list of complications developed by Iezzoni et al. (1994). From that list, we kept only those complications that were likely to have a continued effect after hospital discharge, and therefore to potentially influence the choice of site for post-acute care (e.g., we excluded transient metabolic derangements and side effects of medications). In addition, we augmented the list to include some important complications for the Medicare population that had been omitted from Iezzoni's list. The resulting list of complications included post-operative pulmonary compromise, post-operative gastrointestinal hemorrhage, cellulitis or decubitus ulcer, septicemia, pneumonia, mechanical complications due to a device, implant, or graft, shock or arrest in the hospital, post-operative acute myocardial infarction (AMI), post-operative cardiac abnormalities other than AMI, procedure-related perforation or laceration, venous thrombosis and pulmonary embolism, acute renal failure, miscellaneous complications, delirium, dementia, stroke (for hip fracture and joint replacement patients only), and hip fracture (for stroke and joint replacement patients only).

We also created some condition-specific clinical variables. For hip fracture and joint replacement patients we created indicators of the type of replacement the patient received. Hip fracture patients were classified as having no surgery to pin their hip (i.e. hip replacement), a total replacement, a partial replacement, and/or a revision of a previous joint replacement. We also coded the location of the fracture. For joint replacement patients we coded these indicators, whether they were for a hip or knee, and whether multiple replacements were conducted. For stroke patients we created indicators for the type of stroke.

Characteristics of Discharging Hospitals. Patterns of care and approaches to discharge planning in the acute care hospital can influence the PAC use of patients. Accordingly, we included a number of covariates to capture the orientation of acute care hospitals. They include

size (average daily census or ADC), teaching status (resident to ADC ratio), ownership status (government, private non-profit, or for-profit), Medicare patient percentage, case-mix index of the hospital, and low-income patient percentage. These measures were created using cost report and provider of service data available from the CMS website.

PAC Payment Changes. Trends in PAC use and the effects of the various PAC payment changes are captured using dummy and index variables. A variable for the number of quarters since the first quarter we observe (here the second quarter of 1996) is included to capture underlying trends in the use of PAC. Dummy variables for the seasons are also included in the model to account for seasonal patterns in the severity of patients presenting with these conditions (Laake and Sverre 1996; Aronow and Ahn 2004). Dummy variables for the implementation of the HHA IPS, SNF PPS, the HHA PPS, and the IRF PPS are included to capture the shift in the proportion of patients going to each setting associated with the implementation of these policies. They are set equal to zero before the fourth quarter of 1997, the third quarter of 1998, the fourth quarter of 2000 and the first quarter of 2002, respectively and set equal to one beginning in those quarters. We also included linear terms for the number of quarters since the implementation of each of these policies to capture changes in the "slope" of the time trend due to phase-in effects and ongoing changes in the use of PAC over time. This variable is set to 1 in the quarter following implementation, and increases by 1 in each subsequent quarter.

This specification is based on a number of assumptions. It assumes that a linear time trend and seasonal dummies can capture pre-change effects. Most importantly, it assumes that the payment system changes have ongoing, incremental, linear effects in all the periods after they are implemented. Thus, for example, it assumes that the effects of later payment changes such as the IRF PPS should be measured only after controlling for the implementation and unfolding effects of all of the prior PPSs. It also assumes that the payment changes we did not include in the model, such as the outpatient hospital PPS, do not affect the care patterns we examined.

Severity. We also ran versions of our models that interacted these payment change variables with indicators for more severely ill persons, defined as those who were predicted to have a higher probability of death.[8] This indicator is intended to capture patient severity in a

[8] In order to assess the validity of this severity indicator, we examined IRF resource use and length of for the "high probability of death" group versus the less severe group. We found that the more severely ill patients going to IRFs did have a higher degree of resource use and a longer average length of stay. The severely ill hip fracture and joint

single variable and these interactions are used to test our hypotheses about the differential effects of prospective payment systems on sicker versus healthier patients. The high probability of death was calculated as follows: 1) all of the health status variables in each model were used to predict death within 150 days of discharge for the sample of beneficiaries who were discharged in the first 215 days of 1999; 2) the coefficients from these models were applied to the whole sample to predict likelihood of death; 3) those with a predicted probability of death in the top 25 percent of the distribution for that condition were considered to have a higher probability of death. We used data from a single year to estimate probability of death so that we had a common model of risk across all years. We also included this composite measure of severity in our models as an additional case mix adjustor.

Statistical Analysis

We first identified hospitalized hip fracture, stroke, and lower extremity joint replacement patients, and then examined how each diagnostic group's sociodemographic and clinical characteristics varied by PAC site used. We also examined how PAC use varied by characteristics of the discharging acute hospital. We then fit multinomial logistic regression models, which allow us to incorporate multiple sites into a single choice model and estimate them jointly, of the form:

$\ln \Omega_{m|b}(X) = \ln \frac{\Pr(y = m \mid x)}{\Pr(y = b \mid x)} = \overline{x\beta_{m|b}}$, (where b was the comparison group, no Medicare-paid post-acute care). The covariate vector included patient demographics, complications and comorbidities, discharging hospital characteristics, condition-specific factors, a quarter count, a dummy variable and a post implementation quarter count for each payment system change, and a composite measure of severity. This model allows us to see which patient characteristics and payment system changes predicted use of SNF care, IRF care, or HHC after discharge from acute care in a multivariate framework for more and less complex patients.[9] These logit models demonstrated that there are many different kinds of factors affecting PAC use, that those factors differ between our hip fracture, stroke, and joint replacement samples, and that it is critical to use

---

replacement patients' cost per discharge was approximately $1,500 more and their length of stay two days longer. For stroke patients, whose costs were more variable within the groups, the difference was not as great.

[9] An alternative analytic strategy would have been to use nested logit models, because of the independence of irrelevant alternatives assumption required with the multinomial logit. We attempted to fit such models, however, we could not estimate them because the only choice-specific attributes of the PAC options available to include in the models were distances from the site to beneficiaries' homes.

condition-specific models to adjust measures of access. We also fit sequential logistic regression models in which the first level model predicted use of SNF or IRF care versus no Medicare-paid institutional care and the second level predicted use of IRF versus SNF care conditional on the use of institutional care. The predictions from these models were virtually identical to those from the multinomial logit models, so for ease of exposition we have presented only the multinomials.[10] We tested our assumptions about the specification of the payment change and time trend effects by comparing our model to a fully flexible model with a dummy variable for each quarter. The fit of our "constrained" model was remarkably similar to that of the unconstrained model.[11]

Finally, we assessed the importance of the payment system changes in the choice of PAC site by simulating how much each payment system changed the predicted probabilities of using IRF care, SNF care, and HHC. To look at the effect of payment systems on PAC use we computed standardized predictions in which only payment system effects were varied across all of our observations, and then predicted the odds of using IRF care, SNF care, and HHC for each observation (Lane and Nelder 1982). The resulting predicted rates of use demonstrate the extent to which our models imply the payment systems shifted patients across PAC sites, holding other factors constant.

Results

Table 1 shows the first site of post-acute care to which beneficiaries with our tracer conditions were discharged after their acute stay, by year for 1996 to 2003. Patients in our hip fracture, stroke, and joint replacement samples use PAC at high rates. In 2002, over 85 percent of hip fracture and joint replacement patients used some type of Medicare-covered post-acute care within 30 days of their acute discharge. More than two-thirds of stroke patients used formal PAC. Roughly 22 percent of hip fracture patients and 33 percent of joint replacement patients used IRF care as their first site of PAC. Hip fracture patients were much more likely to use SNF care, however, and stroke patients received home health care at a higher rate than hip fracture patients. Most congestive heart failure patients did not use Medicare-covered PAC in the 30 days after discharge, but of those who did the vast majority used home health care or SNF.

---

[10] The fits were for hip fracture: AIC=1951948 for the two-level model and 1914868 for the multinomial model, for stroke: AIC= 2911411 for the two-level model and 2780111 for the multinomial model, and for joint replacement: AIC= 3160593 for the two-level model and 2858921 for the multinomial.

[11] The differences in the AICs between the constrained and the unconstrained models were extremely small: 427 for hip fracture; 12 for stroke; and 163 for joint replacement.

The patterns of use of PAC did, however, change over time. Use of IRF care over this period increased for all four conditions. In contrast, the use of home health care declined for all four conditions although there was a slight increase between 2001 and 2002 for stroke and joint replacement and it appeared to be leveling off in the first half of 2003. The patterns in use of SNF care varied by year: increasing through 1998 and then tailing off through 2003. CHF was an exception to this pattern; SNF use did decline between 1998 and 1999, but increased through 2003. Since the utilization rates of long-term care hospitals, acute rehabilitation, and outpatient therapy are so low, we do not include patients using those settings in our tables and models discussed below.[12] Use of LTCHs increased over this period for hip fracture and stroke patients but remained below 2 percent.

The characteristics of the hip fracture, stroke, and joint replacement samples are shown in Table 2. The hip fracture sample is older – over half of the hip fracture patients are age 80 or older – and more heavily female, as expected. None of the three groups have a high level of complications, but all three groups have a substantial rate of comorbidities. The hip fracture sample has especially high rates of heart disease, pulmonary disease, diabetes, and dementia. The stroke sample has relatively high rates of heart disease, diabetes, and functional impairment. The joint replacement sample has high rates of diabetes, coronary artery disease, and pulmonary disease. The differences in the characteristics of the areas in which the typical member of these groups live are not notable, but joint replacement patients are discharged from larger hospitals. Our multinomial logit regression models allow us to see the relationships between individual, patient, and area characteristics and choice of post-acute care location, controlling for other variables. The models also allow us to see whether use patterns emerge around the payment system changes. Using our multinomial models, we constructed case-mix adjusted probabilities of use of PAC for our hip fracture, stroke, and joint replacement patients that visually display the effects of the payment systems. Charts 2, 3, and 4 show the adjusted probabilities of discharging hip fracture, stroke, and joint replacement patients to each post-acute care setting. The probability of patients with a hip fracture being discharged without Medicare covered PAC –

[12] Appendix I shows the first type of post-acute care to which beneficiaries with our tracer conditions were discharged after their acute stay in 1999, and includes information on discharges followed by therapy delivered in outpatient settings. These numbers are not directly comparable to those shown in Table 1 since outpatient therapy can occur before the use of other types of care and thus supplant that location as the "first" location post-discharge. It shows that such therapy is rarely the treatment chosen after discharge from acute care for these four conditions. For this reason, we decided not to obtain the Part B files necessary to track the use of outpatient therapy over time. For the rest of our analyses, outpatient therapy is grouped into the no Medicare-paid PAC category.

versus to an IRF, SNF, or HHC – is falling over this time period, while increasing for stroke patients and remaining about the same for joint replacement patients. The probability of going to an IRF increased over time for all three conditions, but especially strongly in joint replacement patients. The probability of going to a SNF peaked in the beginning of 1998 for all three conditions, but fell overall. The probability of using home health care declined for all three conditions, with notable declines associated with the implementation of the HHA IPS and the HHA PPS. Without the payment system changes our models assume that the trends displayed on these charts prior to the first payment system change at the end of 1997 would have continued.

Tables 3a, 3b, and 3c present the detailed results from these logistic regressions using pooled data for the period January 1996 through June 2003. The results for these select variables show us the significance of the changes in utilization patterns associated with payment system changes. The first set of columns shows the predictors of patients going to IRF care, the second SNF care, and the third HHC. A positive coefficient in the first column of numbers within each set generally indicates that patients are more likely to be discharged to an IRF versus get no Medicare-paid post-acute care (the reference group). The implementation effect coefficients should be interpreted as the shift due to implementation, while the time trend effects should be interpreted as a change in slope for each quarter after implementation. However, because the signs and magnitudes of the effects are difficult to interpret from the multinomial logit regression output, we provide corresponding estimates of the changes in the probability of going to each PAC location in the next three columns. A negative percentage in these columns indicates that the patient was less likely to go to that PAC location after the payment system change noted in the row title. A negative percentage in these columns for a time trend effect shows the predicted change in the probability of going to that site in the post-implementation period, evaluated at the quarter following the implementation.

We also ran a model that included interactions for more severely ill patients with the payment system variables to see if they were differentially affected by the changes in payment systems. Including these 10 interaction variables across three PAC location choices resulted in only a few weakly significant effects, as discussed below. The changes in the other coefficients, including the payment change variables, when these interactions were included were very small in magnitude and the effects were not quantitatively different. The results from these models are, therefore, not shown in the attached tables.

Reviewing Tables 3a, 3b, and 3c, our multinomial logit regression models show significant trends in where patients went after discharge from acute care and how that was affected by the various PAC payment systems implemented between 1996 and 2003. The models show that there was an underlying trend of an increase in use of SNF care across all three conditions. Use of home health care was going down for hip fracture and stroke patients with time, while increasing for joint replacement patients. IRF use was increasing for hip fracture and joint replacement patients.

When the BBA mandated the implementation of the HHA IPS in October 1997, the use of home health care went down for all three conditions immediately, and continued to decline for stroke and joint replacement patients in the periods following implementation. The HHA IPS was associated with a reduction in the probability of hip fracture and joint replacement patients going to home health care of 0.4 and 0.6 percentage points, respectively. The HHA IPS reduced the likelihood of a stroke patient going to HHC by about 1.4 percent immediately, and an additional 0.4 percent in the quarter after the payment system changed. There is evidence of a decrease in use of SNFs upon implementation of the HHA IPS for joint replacement patients, and for both stroke and joint replacement patients in the period following implementation.

With the implementation of the SNF PPS in July 1998 there was an immediate decline in SNF use, which was significant for hip fracture and joint replacement patients. After the SNF PPS implementation there was an increase in home health use for all three conditions. The implementation of the SNF PPS was also associated with a decline in use of IRFs for hip fracture and joint replacement patients. In the periods following the implementation of the SNF PPS, however, joint replacement use more IRF care.

The HHA PPS implementation in October 2000 was associated with a large decrease in the use of home health care for all three conditions. The likelihood of going to HHC after the HHA PPS decreased by 0.4 percent for hip fracture patients, 1.5 percent for stroke patients, and 1.2 percent for joint replacement patients. The HHA PPS was associated with a decline in IRF use for hip fracture and stroke patients upon implementation and an increase in stroke patients' use of SNFs and HHAs in the period following implementation.

The implementation of the IRF PPS in January 2002 was associated with an increase in both IRF and SNF use for joint replacement patients. For this group, the likelihood of going to both IRF and SNF increased immediately, by 0.2 percent and 0.7 percent respectively. For hip

fracture patients, the IRF PPS was associated with an immediate increase in use of SNFs, and a subsequent decline in use of SNFs. For stroke patients, the IRF PPS was associated with an increase in use of IRFs.

Limitations

There is clearly room to improve on the methods we have used here and to pursue the next logical steps in this line of inquiry. Our models do not capture PAC payment changes other than the implementation of new payment systems, such as the Balanced Budget Refinement Act (BBRA) or the Benefits Improvement and Protection Act (BIPA). Thus, some of those effects may be partially captured by other indicators. In particular, the increases in SNF use around the time of the HHA PPS and IRF PPS may result from the BBRA and BIPA payment supplements to SNFs. We could also define the severely ill in other ways: for example, based on their probability of long-term institutionalization. When more data become available for analysis we could have a longer time frame over which to examine the effects of the IRF PPS.

Conclusions

Although the effects of the payment systems on the use of PAC varied, most were as predicted and were consistent with the existing literature. There was a marked decline in the use of home health care with the implementation of the HHA IPS, and another decline after the HHA PPS. The decline in the use of HHC after the HHA IPS persisted in the quarters following its implementation for stroke and joint replacement patients. These patients were mostly being shifted from SNF and HHC to no formal care during this time period. This marked continued decline in HHC use after the implementation of the HHA IPS, which was highly significant for stroke and joint replacement patients, may have been because the IPS involved substantial fiscal cuts, was implemented first and relatively quickly so that providers likely took additional time to adjust to it, and because there was a perception that the BBA foretold a crackdown on all post-acute care. The SNF PPS was associated with lower use of SNF care for hip fracture and joint replacement patients and increases over time in HHC use for stroke and joint replacement patients. Some of the payment changes appeared to have immediate consequences for alternative sites including the IRF PPS, which was associated with greater SNF use for hip fracture and joint replacement patients. The IRF PPS was also associated with greater use of IRF care for stroke and joint replacement patients. Across the entire time period examined the proportion of hip

fracture and joint replacement patients receiving no formal PAC was relatively flat, but the proportion of stroke patients receiving no formal PAC increased.

Of course, there were unanticipated effects. For example, the decreases in SNF use around the HHA IPS (which were contrary to our hypothesis) were possibly due to over expansion in the SNF industry, and anticipatory effects of the SNF PPS. In addition, the declines in use of IRFs for hip fracture and joint replacement patients after the SNF PPS and the declines in stroke patients' use of IRFs after the HHA PPS were unexpected but may have been due to the BIPA or BBRA.

There were virtually no differential effects for severely ill patients associated with any of the payment system changes. While this is good news, continued attention should be given to this issue in the future. In addition, it is also interesting to note that the changes described above were least significant and pronounced for hip fracture patients and most pronounced for stroke patients. This is a cause for concern because stroke patients are the group for whom there is the most evidence that aggressive post-acute rehabilitation produces better outcomes (Kramer et al. 1997; Kane et al. 1996, 1998, 2000).

It is important that all of the changes associated with the PAC payment reforms be studied in the context of changes in patient costs and outcomes. For example, declines in the use of any given PAC site would be of greatest concern if they were associated with poorer patient outcomes overall. In addition, it should be noted that these analyses reflect the latest data available, but that they only cover the early stages of the IRF PPS implementation. Therefore, it is important to continuously monitor the impact of the implementation of the IRF PPS as additional data, including data on Medicare costs and outcomes, become available.

References

American Hospital Association, Statement by the (August 6, 1998). Health Subcommittee of the Committee on Ways and Means.

Anderson, W. L., Norton, E. C., & Dow, W. H. (2003). Medicare maximization by state Medicaid programs: effects on Medicare home care utilization. *Med Care Res Rev, 60*(2), 201-222.

Andersen, R. M., McCutcheon, A., Aday, L. A., Chiu, G. Y., & Bell, R. (1983). Exploring dimensions of access to medical care. *Health Serv Res, 18*(1), 49-74.

Angelelli, J., Gifford, D., Intrator, O., Gozalo, P., Laliberte, L., & Mor, V. (2002). Access to postacute nursing home care before and after the BBA. Balanced Budget Act. *Health Aff, 21*(5), 254-264.

Aronow, W.S., & Ahn, C. (2004). Elderly Nursing Home Patients With Congestive Heart Failure After Myocardial Infarction Living in New York City Have a Higher Prevalence of Mortality in Cold Weather and Warm Weather Months. *J Gerontol A Biol Sci Med Sci*, 59A, 146-147.

Beeuwkes Buntin, M., Datar Garten, A., Paddock, S., Saliba, D., Totten, M., & Escarce, J. J. (forthcoming 2005). How Much is Post-Acute Care Use Affected by Its Availability? *Health Services Research.*

Benjamin, A.E. (1986). State variations in home health expenditures and utilization under Medicare and Medicaid. *Home Health Care Serv Q*, 7 (1),5-28.

Blewett, L. A., Kane, R. L., & Finch, M. (1995). Hospital ownership of post-acute care: does it increase access to post-acute care services? *Inquiry, 32*(4), 457-467.

Bronskill, S. E., Normand, S. L., & McNeil, B. J. (2002). Post-acute service use following acute myocardial infarction in the elderly. *Health Care Financ Rev, 24*(2), 77-93.

Chan, L., Koepsell, T. D., Deyo, R. A., Esselman, P. C., Haselkorn, J. K., Lowery, J. K., & Stolov, W. C. (1997). The effect of Medicare's payment system for rehabilitation hospitals on length of stay, charges, and total payments. *N Engl J Med, 337*(14), 978-985.

Cohen, M. A., & Tumlinson, A. (1997). Understanding the state variation in Medicare home health care. The impact of Medicaid program characteristics, state policy, and provider attributes. *Med Care, 35*(6), 618-633.

Cotterill, P. G., & Gage, B. J. (2002). Medicare post-acute care since the Balanced Budget Act of 1997. *Health Care Financ Rev, 24*(2), 1-6.

DeJong, G., Palsbo, S. E., Beatty, P. W., Jones, G. C., Kroll, T., & Neri, M. T. (2002). The Organization and Financing of Health Services for Persons with Disabilities. *Milbank Q, 2,* 261-301.

Dubay, L. C. (1993). Comparison of rural and urban skilled nursing facility benefit use. *Health Care Financ Rev, 14*(4), 25-37.

Ellis, R. P., & McGuire, T. G. (1996). Hospital response to prospective payment: moral hazard, selection, and practice-style effects. *J Health Econ*, 15(3), 257-277.

Finlayson, M. (2002). Changes predicting long-term care use among the oldest-old. *Gerontologist, 42*(4), 443-453.

Gage, B. (1999). Impact of the BBA on post-acute utilization. *Health Care Financ Rev, 20*(4), 103-126.

Iezzoni, L.I., J. Daley, T. Heeren, S.M. Foley, E.S. Fisher, C. Duncan, J.S. Hughes, G.A. Coffman. (1994). Identifying complications of care using administrative data. *Med Care,* 32 (7), 700-715.

Jette, A. M., & Keysor, J. J. (2002). Uses of Evidence in Disability Outcomes and Effectiveness Research. *Milbank Q*, 2, 325-345.

Laake, K., & Sverre, J. M. (1996). Winter excess mortality: a comparison between Norway and England plus Wales. *Age Ageing*, 25(5), 343-348.

Lane, P.W. & Nelder, J.A. (1982). Analysis of covariance and standardization as instances of prediction. *Biometrics*, 38, 613-621

Lee, A. J., Huber, J. H., & Stason, W. B. (1997). Factors contributing to practice variation in post-stroke rehabilitation. *Health Serv Res, 32*(2), 197-221.

Lewis, M. A., Leake, B., Leal-Sotelo, M., & Clark, V. (1987). The initial effects of the prospective payment system on nursing home patients. *Am J Public Health, 77*(7), 819-821.

Liu, K., Baseggio, C., Wissoker, D., Maxwell, S., Haley, J., & Long, S. (2001). Long-Term Care Hospitals Under Medicare: Facility-Level Characteristics. *Health Care Financ Rev, 23*(2), 1-18.

Liu, K., Wissoker, D., & Rimes, C. (1998). Determinants and costs of Medicare post-acute care provided by SNFs and HHAs. *Inquiry, 35*(1), 49-61.

Lurie, N. (2002) Measuring disparities in access to care. In E. Swift (ed.), Guidance for the National Healthcare Disparities Report. Washington, DC: The National Academies Press.

Kane, R. L., Lin, W. C., & Blewett, L. A. (2002). Geographic variation in the use of post-acute care. *Health Serv Res, 37*(3), 667-682.

Kane, R. L., Chen, Q., Finch, M., Blewett, L., Burns, R., & Moskowitz, M. (1998). Functional outcomes of posthospital care for stroke and hip fracture patients under medicare. *J Am Geriatr Soc*, 46(12), 1525-1533.

Kane, R. L., Finch, M., Blewett, L., Chen, Q., Burns, R., & Moskowitz, M. (1996). Use of post-hospital care by Medicare patients. *J Am Geriatr Soc, 44*(3), 242-250.

Kenney, G. M., & Dubay, L. C. (1992). Explaining area variation in the use of Medicare home health services. *Med Care, 30*(1), 43-57.

Komisar, H. L. (2002). Rolling back Medicare home health. *Health Care Financ Rev, 24*(2), 33-55.

Kramer, A. M., Steiner, J. F., Schlenker, R. E., Eilertsen, T. B., Hrincevich, C. A., Tropea, D. A., Ahmad, L. A., & Eckhoff, D. G. (1997). Outcomes and costs after hip fracture and stroke. A comparison of rehabilitation settings. *JAMA*, 277(5), 396-404.

Manton, K. G., Woodbury, M. A., Vertrees, J. C., & Stallard, E. (1993). Use of Medicare services before and after introduction of the prospective payment system. *Health Serv Res, 28*(3), 269-292.

Medicare Payment Advisory Commission. (2004). *Report to the Congress: Medicare Payment Policy*. Washington (DC): MedPAC.

Medicare Payment Advisory Commission. (2003). *Report to the Congress: Variation and Innovation in Medicare*. Washington (DC): MedPAC.

Medicare Payment Advisory Commission. (2003). *Report to the Congress: Medicare Payment Policy*. Washington (DC): MedPAC.

Medicare Payment Advisory Commission. (2002). *Report to the Congress: Medicare Payment Policy*. Washington (DC): MedPAC.

McCall, N., Korb, J., Petersons, A., & Moore, S. (2003). Reforming Medicare payment: early effects of the 1997 Balanced Budget Act on post-acute care. *Milbank Q, 81*(2), 277-303.

McCall, N., Petersons, A., Moore, S., & Korb, J. (2003). Utilization of home health services before and after the Balanced Budget Act of 1997: what were the initial effects? *Health Serv Res, 38*(1), 85-106.

Neu, C. R., Harrison, S. C., & Heilbrunn, J. Z. (1989). *Medicare patients and postacute care: Who goes where?* Santa Monica, CA: RAND.

Schore, J. (1996). Regional Variation in Medicare Home Health: Taking a Closer Look. Report for the Mathematica Policy Research, Inc.

Shatto, A. (2002). Comparing Medicare beneficiaries, by type of post-acute care received: 1999. *Health Care Financ Rev, 24*(2), 137-142.

Steiner, A. and Neu, C.R. (1993). Monitoring the Changes in Use of Medicare Posthospital Services. Report prepared for the Health Care Financing Administration. Santa Monica, CA: RAND.

Stineman, M. G. (2002). Prospective Payment, Prospective Challenge. *Arch Phys Med Rehabil 83,* 1802-1805.

Street, D., Quadagno, J., Parham, L., & McDonald, S. (2003). Reinventing long-term care: the effect of policy changes on trends in nursing home reimbursement and resident characteristics--Florida, 1989-1997. *Gerontologist, 43*(2), 118-131.

Swan, J. H., & Benjamin, A. E. (1990). Medicare Home Health Utilization as a Function of Nursing Home Market Factors. *Health Serv Res, 25*(3), 479-500.

White, C. (2003). Rehabilitation therapy in skilled nursing facilities: effects of Medicare's new prospective payment system. *Health Aff, 22*(3), 214-223.

Yip, J. Y., Wilber, K. H., & Myrtle, R. C. (2002). The impact of the 1997 Balanced Budget Amendment's prospective payment system on patient case mix and rehabilitation utilization in skilled nursing. *Gerontologist, 42*(5), 653-660.

Young, D.A. 1997. "Post-Acute Care." Paper presented at the Princeton Conference on Medicare Reform.

Summary Table: Payment System Changes and Effects

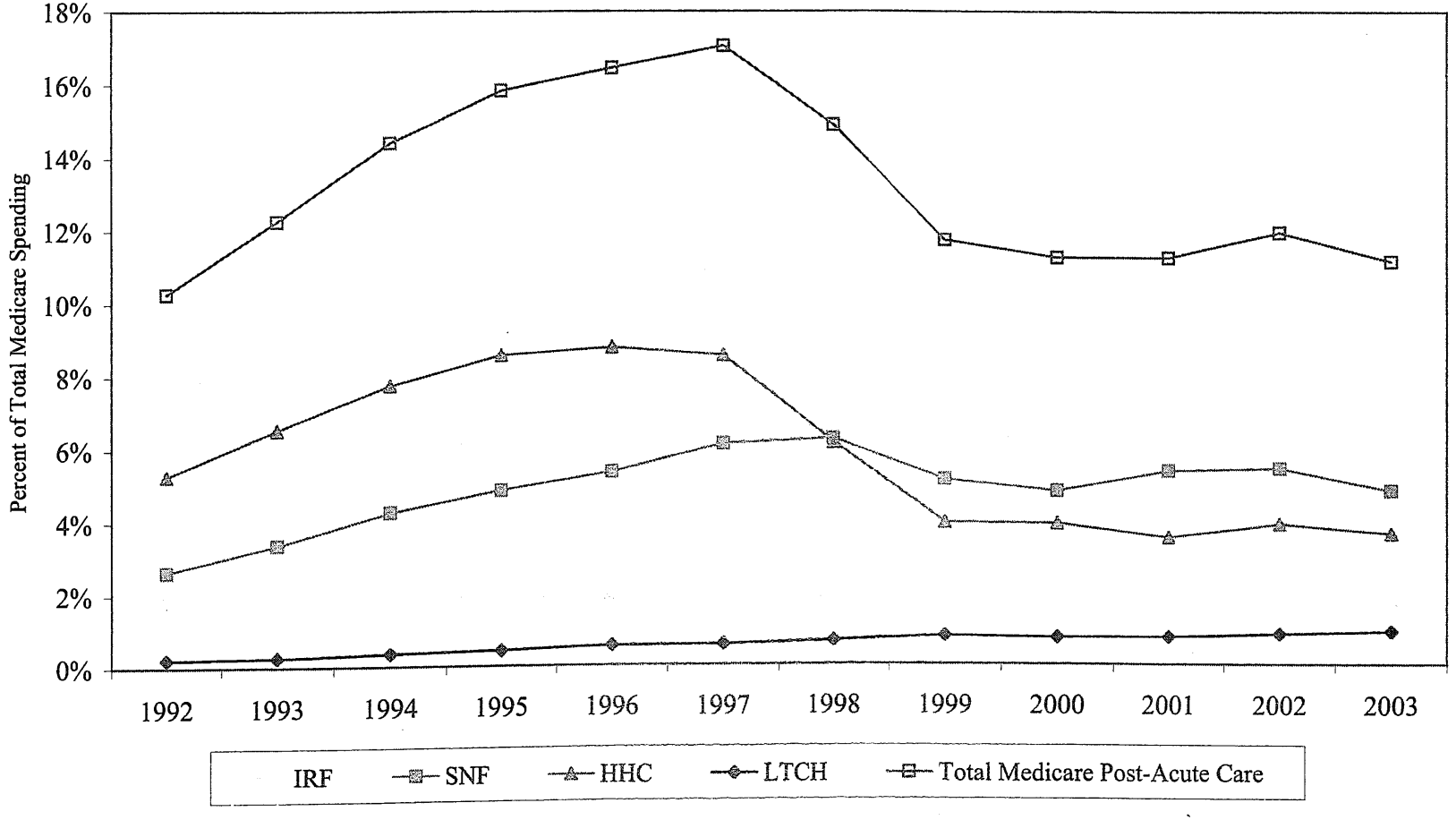
Payment System Implementation Schedule	Date	Changes and Goals	Hypothesized Effects	Observed Significant Effects
Home Health Agency Interim Payment System (HHA IPS)	Oct-97	The IPS was a temporary system put in place by the BBA. Under the interim payment system, HHAs are paid the lesser of (1) actual reasonable costs; (2) the per-visit limits; or (3) the per-beneficiary limits. It was projected to reduce payments to home health agencies by $3.1 billion in FYs 1998 and 1999.	Negative effect on HHA use with implementation and following implementation, especially for severely ill patients. Increase in use of alternative sites over time.	**Hip Fracture:** slight negative implementation effect on HHA use, modest positive time trend effect on IRF use **Stroke:** large negative implementation effect on HHA use, modest negative time trend effect on SNF use, slight negative time trend effect on HHA use **Joint Replacement:** modest negative implementation effect on SNF and HHA use, slight positive time trend effect on IRF use, slight negative time trend effect on SNF and HHA use
Skilled Nursing Facility Prospective Payment System (SNF PPS)	Jul-98	The SNF PPS pays SNFs prospectively on a case-mix adjusted per-diem basis, a change from the former cost-based system. The estimated reduction in SNF payments during the first PPS year averaged 17 percent.	Negative effect on SNF use with implementation and following implementation, especially for severely ill patients. Increase in use of alternative sites over time.	**Hip Fracture:** slight negative implementation effect on IRF use, modest negative implementation effect on SNF use, slight positive time trend effect on HHA use **Stroke:** slight negative time trend effect on SNF use, modest positive time trend effect on HHA use **Joint Replacement:** slight negative implementation effect on IRF use, large negative implementation effect on SNF use, slight positive time trend effect on IRF use, modest positive time trend effect on HHA use
Home Health Agency Prospective Payment System (HHA PPS)	Oct-00	The HHA PPS pays HHAs prospectively on a case-mix adjusted per-episode basis, a change from the former cost-based system with per-beneficiary limits. The HHA PPS was designed to be budget neutral to IPS in FY 2001 (the BBRA postponed the 15% reduction in the budget neutrality target).	Negative effect on HHA use with implementation and following implementation. May increase use of HHC by severely ill patients. Increase in use of alternative sites over time.	**Hip Fracture:** slight negative implementation effect on IRF and HHA use, slight negative time trend effect on IRF use **Stroke:** slight negative implementation effect on IRF use, large negative implementation effect on HHA use, slight positive time trend effect on SNF use **Joint Replacement:** large negative implementation effect on HHA use, slight negative time trend effect on IRF use
Inpatient Rehabilitation Facility Prospective Payment System (IRF PPS)	Jan-02	The IRF PPS pays IRFs prospectively on a case-mix adjusted per-discharge basis, a change from the former cost-based system. The IRF PPS was designed to be budget neutral.	Little effect on use of IRFs overall, may increase use of IRFs by severely ill patients.	**Hip Fracture:** slight positive implementation effect on SNF use, slight negative time trend effect on SNF use **Stroke:** slight positive implementation effect on IRF use **Joint Replacement:** slight positive implementation effect on IRF use, modest positive implementation effect on SNF use, slight negative implementation effect on HHA use

Table 1: First Location of Post-Acute Care Within 30 Days of Discharge
1996 to 2003

Hip Fracture Patients	1996		1997		1998		1999		2000		2001		2002		2003	
First PAC Location	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*
No Medicare-Paid PAC	19,026	9.2%	17,246	8.6%	16,324	8.4%	15,674	8.2%	13,936	7.4%	13,679	7.1%	12,064	6.3%	11,852	6.0%
Home Health	19,637	9.5%	15,854	7.9%	12,583	6.5%	12,297	6.4%	11,976	6.3%	11,503	6.0%	11,271	5.9%	11,636	5.9%
IRF	37,475	18.2%	35,064	17.4%	35,252	18.2%	37,192	19.3%	39,307	20.7%	41,107	21.4%	42,720	22.4%	45,942	23.3%
SNF	127,850	62.0%	131,446	65.2%	128,011	66.0%	124,534	64.8%	121,722	64.2%	122,552	63.9%	121,318	63.7%	124,102	63.0%
Acute rehab	413	0.2%	399	0.2%	470	0.2%	619	0.3%	518	0.3%	516	0.3%	322	0.2%	260	0.1%
LTCH	1,854	0.9%	1,502	0.7%	1,407	0.7%	1,898	1.0%	2,026	1.1%	2,497	1.3%	2,852	1.5%	3,174	1.6%
Total	206,255	100%	201,511	100%	194,047	100%	192,214	100%	189,485	100%	191,854	100%	190,547	100%	196,966	100%
Death Rate within 30 days of discharge	5.38		5.43		5.68		6.08		6.16		6.27		6.58		6.54	
Rehospitalization Rate within 30 days of discharge	11.53		11.91		12.09		12.87		13.12		13.69		14.22		15.05	
Stroke Patients	**1996**		**1997**		**1998**		**1999**		**2000**		**2001**		**2002**		**2003**	
First PAC Location	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*
No Medicare-Paid PAC	76,665	27.4%	73,356	27.2%	74,162	29.3%	72,781	30.1%	69,893	30.5%	77,939	32.0%	75,310	31.3%	75,990	31.3%
Home Health	57,953	20.7%	52,229	19.3%	40,669	16.1%	37,476	15.5%	35,198	15.4%	34,660	14.3%	34,671	14.4%	34,928	14.4%
IRF	56,581	20.2%	54,740	20.3%	51,490	20.4%	51,144	21.1%	49,659	21.7%	51,411	21.1%	52,504	21.8%	53,360	22.0%
SNF	84,957	30.3%	86,532	32.0%	82,967	32.8%	76,638	31.7%	70,355	30.7%	74,440	30.6%	73,364	30.5%	73,480	30.2%
Acute rehab	579	0.2%	523	0.2%	599	0.2%	733	0.3%	592	0.3%	571	0.2%	324	0.1%	266	0.1%
LTCH	3,266	1.2%	2,798	1.0%	2,802	1.1%	3,184	1.3%	3,471	1.5%	4,178	1.7%	4,419	1.8%	4,956	2.0%
Total	280,001	100%	270,178	100%	252,689	100%	241,956	100%	229,168	100%	243,199	1.0	240,592	1.0	242,980	100%
Death Rate within 30 days of discharge	8.79		9.11		9.46		9.92		9.89		10.18		10.21		10.69	
Rehospitalization Rate within 30 days of discharge	12.49		12.78		13.01		11.33		15.39		13.99		14.51		14.90	
Joint Replacement Patients	**1996**		**1997**		**1998**		**1999**		**2000**		**2001**		**2002**		**2003**	
First PAC Location	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*
No Medicare-Paid PAC	38,131	15.1%	34,586	13.6%	35,282	14.3%	37,114	15.0%	37,983	14.6%	46,662	15.7%	48,812	15.2%	55,324	15.4%
Home Health	68,198	27.0%	61,999	24.5%	54,266	21.9%	54,153	21.9%	56,679	21.8%	63,045	21.2%	69,642	21.7%	80,206	22.3%
IRF	62,360	24.7%	65,644	25.9%	66,338	26.8%	69,556	28.2%	79,714	30.7%	94,317	31.8%	106,256	33.1%	121,288	33.7%
SNF	81,872	32.4%	89,726	35.4%	89,866	36.3%	83,932	34.0%	83,435	32.1%	90,497	30.5%	93,877	29.3%	100,782	28.0%
Acute rehab	576	0.2%	618	0.2%	753	0.3%	1,079	0.4%	785	0.3%	1,008	0.3%	682	0.2%	614	0.2%
LTCH	1,402	0.6%	883	0.3%	747	0.3%	995	0.4%	1,099	0.4%	1,489	0.5%	1,671	0.5%	1,926	0.5%
Total	252,539	100%	253,456	100%	247,252	100%	246,829	100%	259,695	100%	297,018	100%	320,940	100%	360,140	100%
Death Rate within 30 days of discharge	0.35		0.40		0.38		0.38		0.37		0.34		0.35		0.32	
Rehospitalization Rate within 30 days of discharge	5.85		6.00		6.08		6.24		6.34		6.49		6.71		6.45	
Congestive Heart Failure Patients	**1996**		**1997**		**1998**		**1999**		**2000**		**2001**		**2002**		**2003**	
First PAC Location	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*
No Medicare-Paid PAC	274,364	50.2%	280,013	50.4%	303,721	55.4%	308,482	57.5%	322,526	58.4%	346,059	60.9%	348,030	59.8%	386,030	58.6%
Home Health	199,782	36.5%	193,107	34.7%	157,676	28.8%	144,308	26.9%	139,532	25.3%	124,208	21.9%	129,379	22.2%	149,826	22.8%
IRF	4,681	0.9%	5,285	1.0%	6,201	1.1%	7,263	1.4%	8,216	1.5%	9,181	1.6%	9,999	1.7%	11,748	1.8%
SNF	66,622	12.2%	75,852	13.6%	78,657	14.4%	74,585	13.9%	79,361	14.4%	85,240	15.0%	91,094	15.6%	106,036	16.1%
Acute rehab	65	0.0%	75	0.0%	93	0.0%	115	0.0%	131	0.0%	111	0.0%	62	0.0%	78	0.0%
LTCH	1,331	0.2%	1,553	0.3%	1,710	0.3%	2,178	0.4%	2,587	0.5%	3,084	0.5%	3,748	0.6%	4,636	0.7%
Total	546,845	100%	555,885	100%	548,058	100%	536,933	100%	552,353	100%	567,883	100%	582,312	100%	658,354	100%
Death Rate within 30 days of discharge	6.64		6.62		6.73		6.71		6.64		6.72		7.26		7.21	
Rehospitalization Rate within 30 days of discharge	23.77		24.22		24.48		24.93		25.14		25.35		19.60		20.18	

Notes: Table includes all Medicare discharges from acute care including those for patients under 65 years of age and those in the nursing home before their acute stay.
Outpatient therapy is not included as a post-acute care site. Those patients receiving only outpatient therapy are grouped in the "No Medicare-Paid PAC" category.
We only have 6 months of data for 2003. These data have been calendarized by multiplying by 2.

Chart 1: Spending on Post-Acute Care by Setting as Percentage of Total Medicare Spending
1992 to 2003



Notes: Dollars are program spending figures and do not include beneficiary copayments. Spending for 2002 and 2003 is estimated.
Source: CMS, Office of the Actuary.

Table 2: Means of Characteristics
1996 to 2003

Variable	Hip Fracture Mean	Hip Fracture Standard Deviation	Stroke Mean	Stroke Standard Deviation	Joint Replacement Mean	Joint Replacement Standard Deviation
Demographics						
Female	0.783	0.412	0.598	0.490	0.652	0.476
White	0.936	0.245	0.843	0.364	0.927	0.261
Black	0.036	0.186	0.117	0.322	0.047	0.213
Hispanic	0.008	0.090	0.013	0.113	0.008	0.090
65<=AGE<=67	0.026	0.160	0.071	0.258	0.122	0.327
68<=AGE<=70	0.037	0.189	0.089	0.285	0.152	0.359
71<=AGE<=73	0.057	0.231	0.111	0.314	0.170	0.376
74<=AGE<=76	0.083	0.276	0.129	0.335	0.172	0.378
77<=AGE<=79	0.114	0.318	0.139	0.345	0.152	0.359
80<=AGE<=82	0.140	0.347	0.135	0.342	0.109	0.311
83<=AGE<=85	0.155	0.362	0.120	0.325	0.068	0.252
86<=AGE<=88	0.149	0.357	0.094	0.293	0.035	0.183
AGE>88	0.238	0.426	0.111	0.315	0.019	0.138
Lives in an MSA	0.713	0.452	0.716	0.451	0.692	0.462
Lives adjacent to an MSA	0.157	0.363	0.158	0.365	0.166	0.372
Beneficiary is covered by Medicaid	0.211	0.408	0.206	0.404	0.082	0.275
Complications						
Post-operative pulmonary compromise	0.010	0.102	0.013	0.112	0.005	0.067
Post-operative GI hemorrhage or ulceration	0.007	0.082	0.010	0.098	0.003	0.051
Cellulitis or decubitus ulcer	0.021	0.143	0.017	0.130	0.005	0.072
Septicemia	0.001	0.026	0.001	0.038	0.000	0.018
Mechanical complications due to device or implant	0.008	0.091	0.006	0.076	0.014	0.116
Miscellaneous complications	0.008	0.088	0.001	0.038	0.014	0.116
Shock or cardiorespiratory arrest	0.002	0.043	0.003	0.050	0.001	0.032
Post-op heart attack (AMI)	0.010	0.100	0.009	0.095	0.004	0.061
Post-op cardiac abnormalities other than AMI	0.001	0.037	0.002	0.046	0.001	0.025
Procedure-related laceration or perforation	0.003	0.051	0.004	0.062	0.001	0.036
Venous thrombosis or pulmonary embolism	0.006	0.076	0.004	0.067	0.006	0.077
Iatrogenic complications	0.045	0.207	0.002	0.045	0.047	0.212
Sentinel Events	0.001	0.033	0.001	0.034	0.001	0.036
Comorbidities						
Acute renal failure	0.007	0.086	0.008	0.088	0.004	0.060
Delirium	0.020	0.141	0.013	0.115	0.012	0.108
Cancer with a Poor Prognosis	0.010	0.099	0.009	0.093	0.003	0.054
Metastatic Cancer	0.006	0.075	0.008	0.090	0.001	0.031
Chronic Pulmonary Disease	0.172	0.377	0.126	0.331	0.100	0.300
Coronary Artery Disease	0.207	0.405	0.244	0.429	0.155	0.362
Congestive Heart Failure	0.169	0.375	0.162	0.368	0.055	0.228
Peripheral Vascular Disease	0.041	0.198	0.060	0.237	0.019	0.136
Severe Chronic Liver Disease	0.004	0.064	0.003	0.052	0.002	0.039
Diabetes with End Organ Damage	0.015	0.120	0.033	0.178	0.008	0.087
Chronic Renal Failure	0.008	0.091	0.009	0.095	0.002	0.043
Nutritional Deficiencies	0.022	0.146	0.020	0.138	0.002	0.049
Dementia	0.226	0.418	0.115	0.319	0.012	0.108
Functional Impairment	0.047	0.212	0.297	0.457	0.009	0.096
Diabetes without End Organ Damage	0.134	0.341	0.232	0.422	0.126	0.332
Pneumonia	0.035	0.185	0.047	0.212	0.007	0.086
Stroke	0.006	0.075	--	--	0.002	0.041
Hip fracture	--	--	0.005	0.068	--	--
Composite Measure of Severity	0.255	0.436	0.262	0.440	0.258	0.438
Discharging Hospital Characteristics						
Non-Profit Hospital	0.750	0.433	0.733	0.442	0.779	0.415
Government Hospital	0.116	0.320	0.131	0.337	0.094	0.292
Average Daily Census of Hospital	177.518	159.269	184.966	167.865	197.224	164.922
Resident to ADC ratio of Hospital	0.100	0.210	0.113	0.228	0.130	0.294
Percentage of Low Income Patients	0.130	0.090	0.137	0.098	0.128	2.865
% Medicare days	0.492	0.124	0.495	0.131	0.480	0.123
Case Mix Index of Hospital	1.440	0.227	1.436	0.247	1.520	0.242
Condition-Specific Factors						
Pertrochanteric Fracture	0.492	0.500	--	--	--	--
Total hip replacement	0.029	0.169	--	--	0.290	0.454
Partial hip replacement	0.332	0.471	--	--	0.019	0.138
Total Knee Replacement	--	--	--	--	0.582	0.493
Knee Revision	--	--	--	--	0.051	0.220
Hip Revision	0.002	0.040	--	--	0.059	0.235
Hip Replacement	--	--	--	--	0.367	0.482
Knee Replacement	--	--	--	--	0.632	0.482
Bilateral Procedure	--	--	--	--	0.042	0.200
Basilar Artery Infarct	--	--	0.003	0.055	--	--
Carotid, verterbral, or multiple artery	--	--	0.063	0.243	--	--
Hemoraghic Stroke	--	--	0.073	0.261	--	--

Table 3a: Multinomial Regressions, First PAC Site, Hip Fracture Patients 1996 to 2003

Variable	IRF Coefficient (Std. Error)	SNF Coefficient (Std. Error)	HHC Coefficient (Std. Error)	Change in Predicted Probability to Site: No Medicare-Paid PAC	IRF	SNF	HHC
Baseline Time Trend (Quarter Dummy)	0.0131 *	0.0276 **	-0.0211 **				
	(.0047)	(.0041)	(.0055)				
HHA Interim Payment System Implementation Effect (10/97)	-0.0173	-0.0231	-0.1040 **	0.18%	0.14%	0.10%	-0.42%
	(.0271)	(.0234)	(.0320)				
HHA Interim Payment System Time Trend Effect	0.0467 *	-0.0071	0.0074	-0.01%	0.68%	-0.67%	0.01%
	(.0161)	(.0140)	(.0195)				
SNF Prospective Payment System Implementation Effect (7/98)	-0.1045 *	-0.0938 *	-0.0297	0.59%	-0.30%	-0.60%	0.30%
	(.0362)	(.0315)	(.0443)				
SNF Prospective Payment System Time Trend Effect	-0.0165	-0.0013	0.0372 *	0.00%	-0.23%	0.00%	0.23%
	(.0154)	(.0134)	(.0188)				
HHA Prospective Payment System Implementation Effect (10/00)	-0.0581 *	-0.0345	-0.1245 **	0.28%	-0.24%	0.39%	-0.44%
	(.0227)	(.0203)	(.0283)				
HHA Prospective Payment System Time Trend Effect	-0.0156 *	0.0078	-0.0085	-0.02%	-0.27%	0.34%	-0.05%
	(.0073)	(.0065)	(.0091)				
IRF Prospective Payment System Implementation Effect (1/02)	0.0495	0.0510 *	0.0303	-0.30%	0.05%	0.33%	-0.08%
	(.0283)	(.0256)	(.0355)				
IRF Prospective Payment System Time Trend Effect	-0.0012	-0.0200 *	0.0045	0.09%	0.20%	-0.39%	0.10%
	(.0087)	(.0079)	(.0109)				
Pseudo R^2	0.0746						
Percentage of PAC patients at this location				7.47 %	20.24 %	65.68 %	6.60 %
Sample Size (N)	1,326,537						

Notes: The comparison group is No Medicare-Paid PAC.
* indicates significance at the 0.05 level, ** at the 0.001 level.

Table 3b: Multinomial Regressions, First PAC Site, Stroke Patients
1996 to 2003

Variable	IRF Coefficient (Std. Error)	SNF Coefficient (Std. Error)	HHC Coefficient (Std. Error)	Change in Predicted Probability to Site: No Medicare-Paid PAC	IRF	SNF	HHC
Baseline Time Trend (Quarter Dummy)	0.0002	0.0120 **	-0.0131 **				
	(.0030)	(.0027)	(.0029)				
HHA Interim Payment System Implementation Effect (10/97)	-0.0284	-0.0185	-0.1200 **	0.85%	0.08%	0.51%	-1.44%
	(.0170)	(.0155)	(.0172)				
HHA Interim Payment System Time Trend Effect	-0.0169	-0.0479 **	-0.0574 **	0.74%	0.24%	-0.54%	-0.43%
	(.0101)	(.0091)	(.0104)				
SNF Prospective Payment System Implementation Effect (7/98)	-0.0019	-0.0149	0.0068	0.09%	0.05%	-0.33%	0.19%
	(.0223)	(.0203)	(.0233)				
SNF Prospective Payment System Time Trend Effect	0.0185	0.0179 *	0.0638 **	-0.54%	-0.06%	-0.15%	0.75%
	(.0096)	(.0087)	(.0100)				
HHA Prospective Payment System Implementation Effect (10/00)	-0.0465 **	-0.0019	-0.1226 **	0.82%	-0.29%	0.99%	-1.51%
	(.0137)	(.0127)	(.0149)				
HHA Prospective Payment System Time Trend Effect	0.0025	0.0248 **	0.0110 *	-0.26%	-0.16%	0.43%	0.00%
	(.0044)	(.0041)	(.0048)				
IRF Prospective Payment System Implementation Effect (1/02)	0.0333 *	0.0292	0.0115	-0.44%	0.26%	0.30%	-0.12%
	(.0166)	(.0155)	(.0184)				
IRF Prospective Payment System Time Trend Effect	0.0049	-0.0070	-0.0024	0.04%	0.13%	-0.16%	-0.01%
	(.0051)	(.0048)	(.0057)				
Pseudo R^2	0.0855						
Percentage of PAC patients at this location				29.62 %	21.33 %	32.53 %	16.52 %
Sample Size (N)	1,589,792						

Notes: The comparison group is No Medicare-Paid PAC.
* indicates significance at the 0.05 level, ** at the 0.001 level.

Table 3c: Multinomial Regressions, First PAC Site, Joint Replacement Patients 1996 to 2003

Variable	IRF Coefficient (Std. Error)	SNF Coefficient (Std. Error)	HHC Coefficient (Std. Error)	Change in Predicted Probability to Site: No Medicare-Paid PAC	IRF	SNF	HHC
Baseline Time Trend (Quarter Dummy)	0.0433 **	0.0567 **	0.0070 *				
	(.0035)	(.0034)	(.0034)				
HHA Interim Payment System Implementation Effect (10/97)	-0.0373	-0.0696 **	-0.0858 **	0.54%	0.54%	-0.52%	-0.56%
	(.0198)	(.0190)	(.0196)				
HHA Interim Payment System Time Trend Effect	-0.0502 **	-0.0633 **	-0.0521 **	0.49%	0.04%	-0.47%	-0.06%
	(.0116)	(.0112)	(.0116)				
SNF Prospective Payment System Implementation Effect (7/98)	-0.0787 *	-0.0989 **	-0.0207	0.58%	-0.23%	-1.15%	0.80%
	(.0257)	(.0248)	(.0260)				
SNF Prospective Payment System Time Trend Effect	0.0242 *	-0.0121	0.0446 **	-0.13%	0.37%	-0.88%	0.64%
	(.0111)	(.0107)	(.0111)				
HHA Prospective Payment System Implementation Effect (10/00)	-0.0150	0.0075	-0.0876 **	0.21%	0.04%	0.97%	-1.22%
	(.0147)	(.0147)	(.0152)				
HHA Prospective Payment System Time Trend Effect	-0.0148 **	0.0035	0.0031	0.01%	-0.34%	0.24%	0.09%
	(.0046)	(.0046)	(.0047)				
IRF Prospective Payment System Implementation Effect (1/02)	0.0659 **	0.0759 **	0.0338 *	-0.48%	0.18%	0.68%	-0.38%
	(.0166)	(.0167)	(.0172)				
IRF Prospective Payment System Time Trend Effect	-0.0021	-0.0020	0.0000	0.01%	-0.02%	-0.02%	0.02%
	(.0051)	(.0051)	(.0053)				
Pseudo R^2	0.069						
Percentage of PAC patients at this location				14.29 %	30.13 %	33.41 %	22.17 %
Sample Size (N)	1,787,114						

Notes: The comparison group is No Medicare-Paid PAC.
* indicates significance at the 0.05 level, ** at the 0.001 level.

Chart 2: Predicted Probabilites of Hip Fracture Patients going to each PAC Location
1996 to 2003

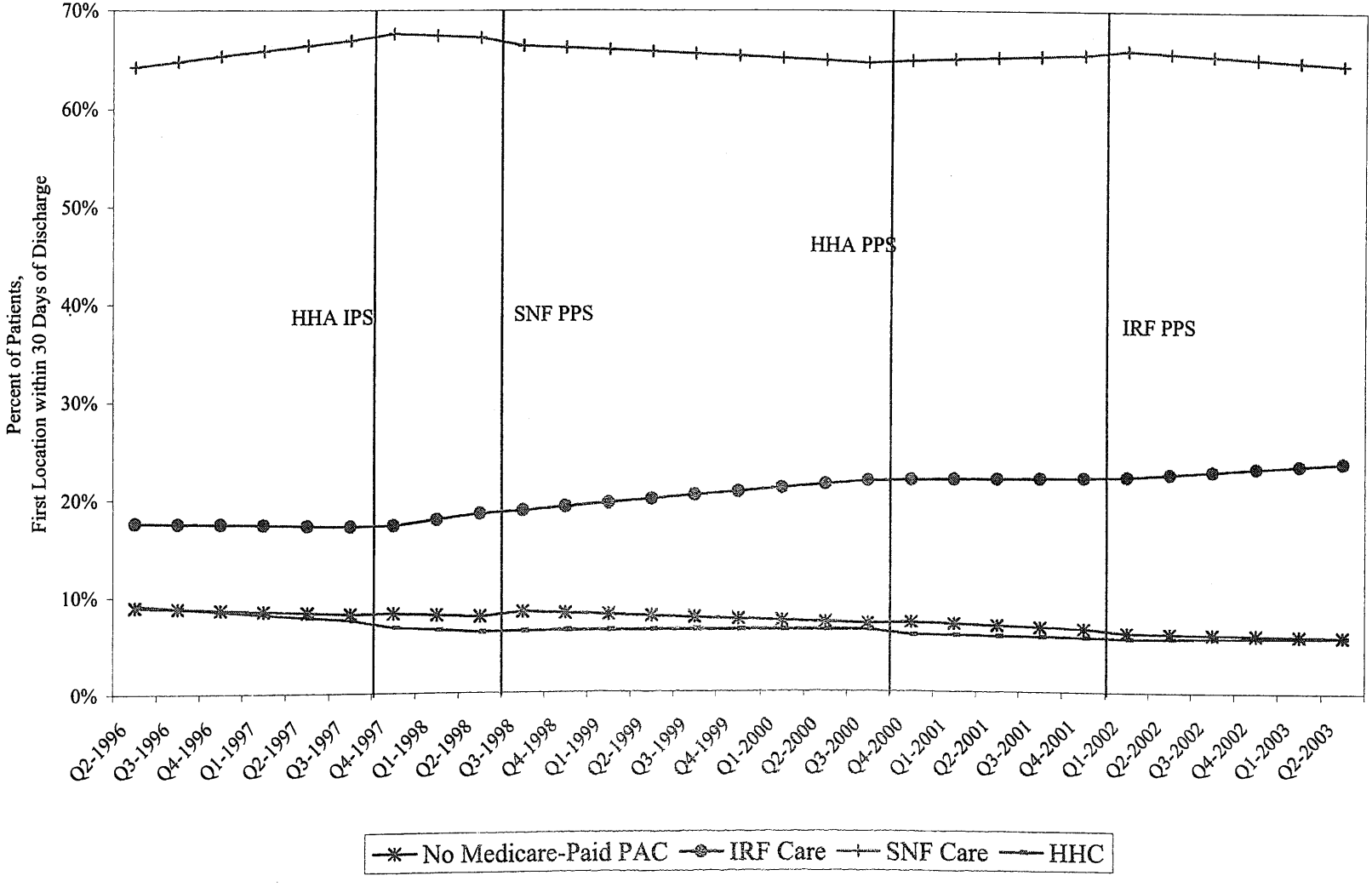


Chart 3: Predicted Probabilites of Stroke Patients going to each PAC Location 1996 to 2003

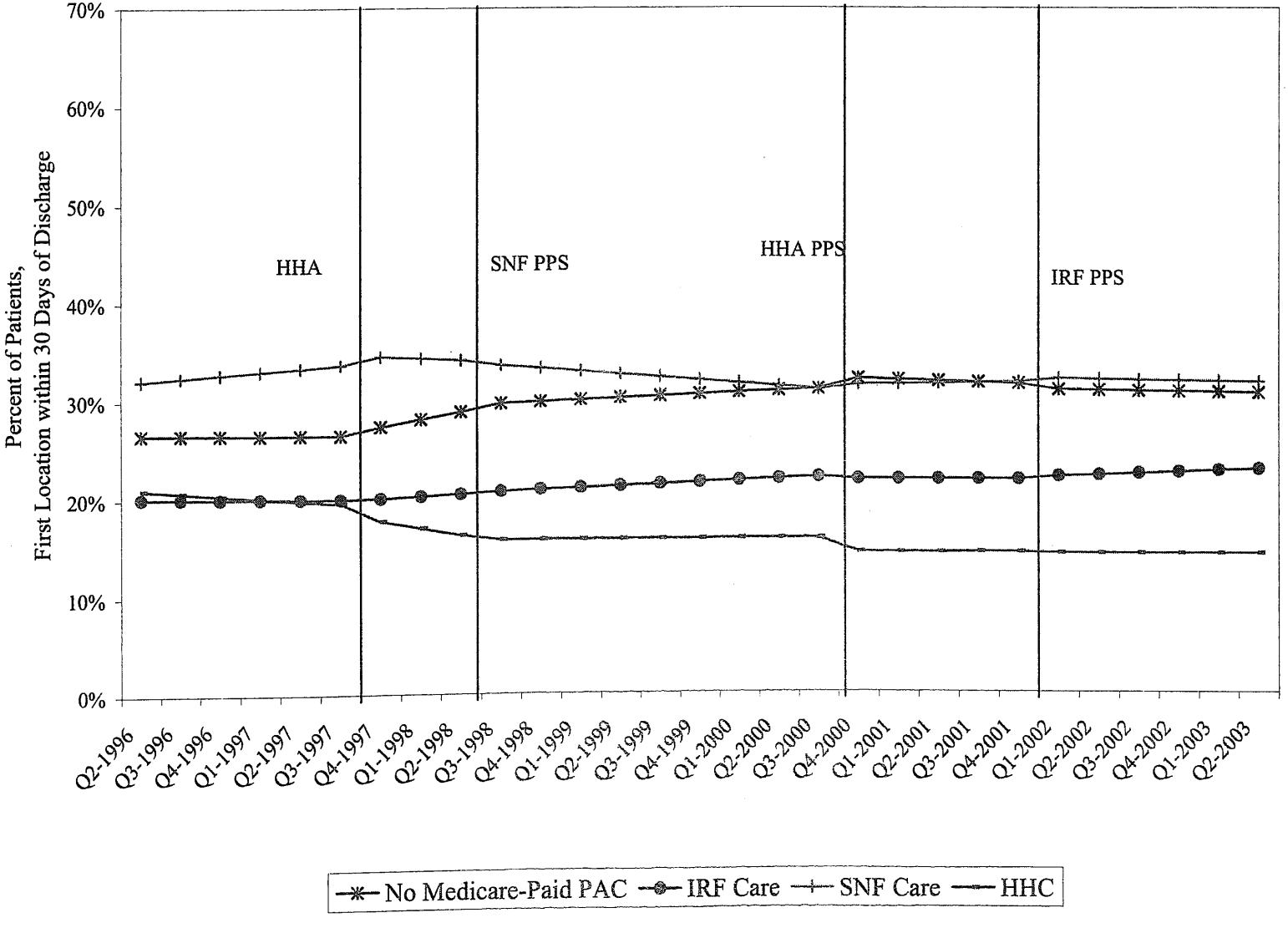
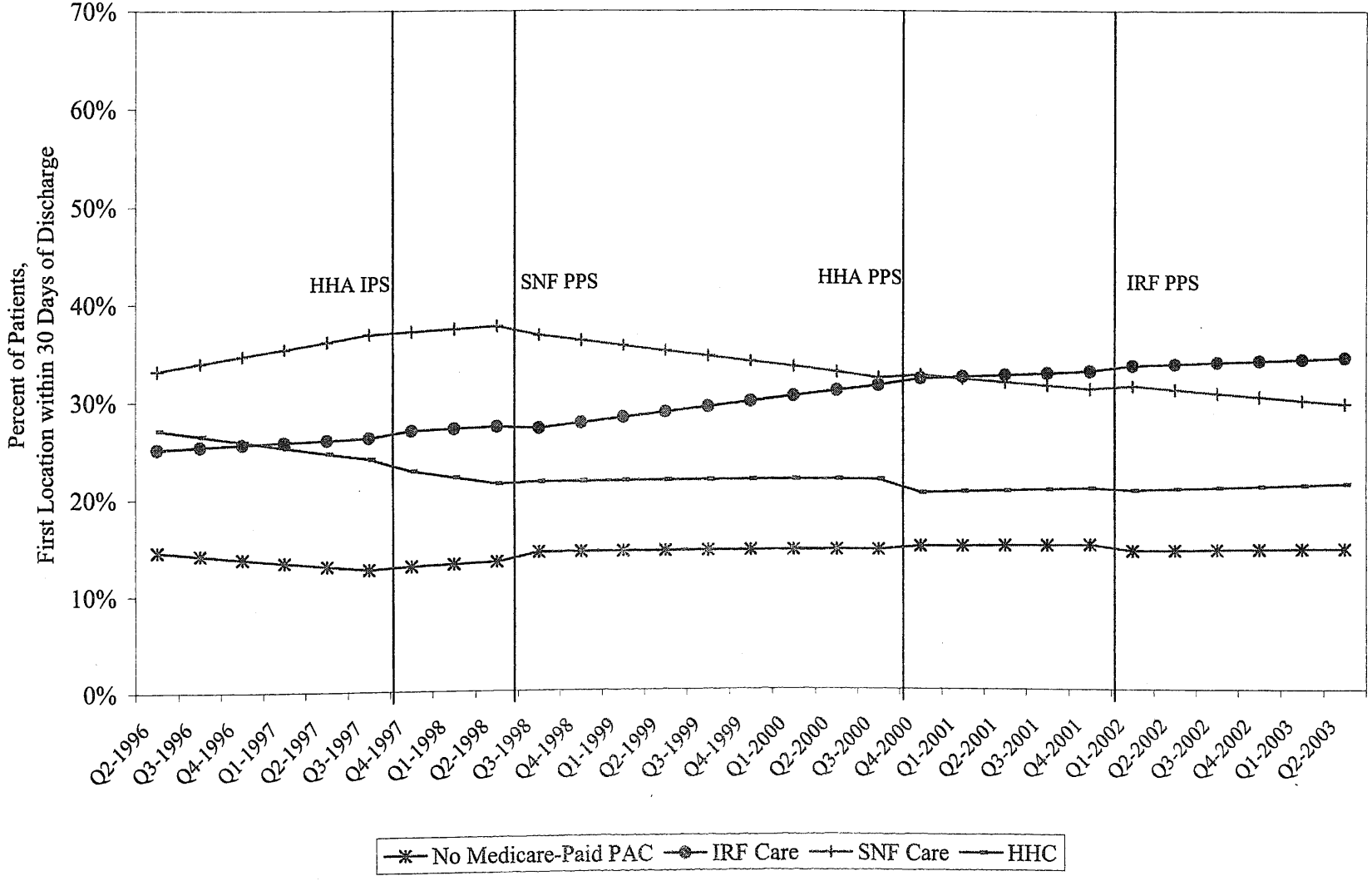


Chart 4: Predicted Probabilites of Joint Replacement Patients going to each PAC Location 1996 to 2003



Appendix I: Outpatient Therapy

First PAC Location 1999	Congestive Heart Failure		Joint Replacement		Hip Fracture		Stroke	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
No Medicare-Paid PAC	228,166	56.3	27,059	11.4	12,785	7.1	58,496	26.2
Home Health	103,723	25.6	49,217	20.7	11,146	6.2	32,769	14.7
OPD Therapy	8,109	2.0	12,084	5.1	4,881	2.7	12,478	5.6
Phy/Supp Therapy	1,431	0.4	3,761	1.6	177	0.1	986	0.4
IRF	5,625	1.4	64,041	26.9	34,043	18.9	46,315	20.7
SNF	56,615	14.0	79,641	33.5	114,721	63.7	68,875	30.8
Acute rehab	102	0.0	1,212	0.5	664	0.4	856	0.4
LTCH	1,502	0.4	936	0.4	1,634	0.9	2,727	1.2
Total	**405,273**	**100.0**	**237,951**	**100.0**	**180,051**	**100.0**	**223,502**	**100.0**
Death Rate Within 30 Days of Discharge	6.8		0.4		6.0		9.8	
Rehospitalization Rate Within 30 Days of Discharge	23.3		6.6		12.1		13.8	

Appendix 3

Changes in IRF Patient Severity Following Implementation of the IRF PPS

Completed Under Contract DRR-3323-CMS

This report was prepared under contract with RAND Corporation by Susan M. Paddock, Jose Escarce, Orla Hayden and Melinda Beeukes Buntin.

PREFACE

Since the inception of the Inpatient Rehabilitation Facility Prospective Payment System (IRF PPS) in 2002, RAND has been contracted by the Centers for Medicare and Medicaid Services (CMS) to support its efforts to monitor the effect of the IRF PPS. To date, RAND has provided a number of analyses and reports on patient access to and utilization of IRF services before and after the implementation of the IRF PPS. Our reports address the Congressional mandate for a study of IRF patient access to care. This report focuses specifically on whether the implementation of IRF PPS has affected patient access to care, especially for patients who are considered "severely ill" and in need of significant levels of care. This report was prepared for CMS, but should also be of interest to individuals in the health care and policy-making arenas who are concerned about Medicare beneficiaries' access to care.

This work was sponsored by CMS under contract 500-2004-00033C and carried out under the auspices of RAND Health, a unit of the RAND Corporation. Comments or inquiries should be sent to the first author of this report, Susan Paddock (Susan_Paddock@rand.org). For more information about RAND Health, please visit http://www.rand.org/health/. We would like to thank Donna Farley of RAND and Bowen Garrett of the Urban Institute for reviewing this document and providing helpful comments. We also thank Barbara Meade of RAND for editorial comments and Regina Hollins for administrative assistance. The mailing address is RAND Corporation, 1776 Main Street, Santa Monica, CA 90407-2138. More information about RAND is available at http://www.rand.org.

Table of Contents

Preface ii
Tables and Figures iv
Executive Summary v
1. Introduction 1
2. Background and Conceptual Framework 3
3. Hypotheses 6
4. Data and Methods 7
5. Results 15
6. Discussion 20
References 23

example, the IRF PAI now specifies that bowel functioning should be scored at the least independent level observed during the week leading up to the assessment, while previously the level was scored based on the first 72 hours in the IRF. This change could have the effect of lowering the bowel functioning score. Both coding practice and coding instruction changes make it difficult to measure case-mix changes over time (Carter and Paddock, 2005).

3. HYPOTHESES

The theoretical and observed effects of prospective payment led us to develop the following hypotheses about changes in access to IRF care that might be realized following the IRF PPS implementation. Our work was designed to test these hypotheses:

1) Following the IRF PPS implementation, fewer patients with particularly costly conditions will be admitted from acute care.
2) More severe cases will have reduced admission rates under the IRF PPS. Specifically, relatively severe patients within case-mix and comorbidity groups may experience reduced access to IRF care.
3) Patients will receive a lower intensity of care under the IRF PPS.

These hypotheses reflect two approaches to identifying the effects of the IRF PPS on access to care for relatively severe patients. The first hypothesis addresses whether the composition of IRF cases having specific, expensive conditions differs pre- versus post-IRF PPS implementation across case-mix groups. The second and third hypotheses identify effects that occur mostly within case-mix groups. The structure of the IRF PPS offers an incentive for facilities to treat relatively less severe cases within the same payment category; e.g., to treat patients with relatively high functional status within a

given CMG. In addition, some across-case-mix group measures related to hypotheses 2 and 3 that do not focus on relative severity within CMG-comorbidity group were examined as well.

Understanding whether access to care changed for more severe patients under the IRF PPS is complicated by the fact that coding instructions and incentives changed with the implementation of the IRF PPS. Thus, the approach we used to create severity measures included only variables that are largely exogenous to payment system incentives and coding changes[1].

4. DATA AND METHODS

Data Sources

We utilized several data sources for our analysis. We have complete data on Medicare bills for all IRF, acute care, home health, skilled nursing facility, and long-term care hospital stays for calendar years 1999 through 2002. The universe of IRF cases includes all Medicare-paid discharges from IRFs except for Maryland cases, since Maryland has its own prospective payment system and is exempt from the IRF PPS. We have FIM™ data on patient functional status at admission on a sample of cases in 1999 and 2002. The Uniform Data Systems for Medical Rehabilitation (UDSmr) and HealthSouth provided FIM™ data for a sample of IRFs in 1999. FIM™ data were collected for all cases in 2002 as part of the IRF Patient Assessment Instrument (IRF PAI), which is completed at admission and discharge for each rehabilitation patient as mandated under the IRF PPS. These data contain descriptions of the patient and the hospitalization, including the condition requiring rehabilitation and the FIM™ items at

[1] As discussed below, this approach does not completely account for all potential selection mechanisms.

admission and discharge. We matched the IRF Medicare bills to the FIM™ data in both 1999 and 2002, resulting in analysis data sets representing 65 percent and 95 percent of all cases in 1999 and 2002, respectively. The 1999 matched sample is largely representative of the IRF universe in that year, although racial minorities, those 95 years or older, and aged patients with end-stage renal disease were slightly underrepresented. The set of IRFs with FIM™ data in 1999 under-represented IRF units of acute care hospitals, rural facilities, and those with a high proportion of low-income patients. Finally, we utilized the Medicare bills for the acute hospitalization that preceded admission to the IRF, provided it occurred in the six months preceding rehabilitation admission. In both 1999 and 2002, 95 percent of IRF cases had such a preceding acute care stay. We also have data for the universe of discharges on the acute care stays that occurred in the six months prior to the IRF admission; about 95% of the IRF stays had a preceding acute care stay. In addition, we have characteristics of the hospitals in which the IRF patients had their preceding acute care stays from the PPS impact file.

Analytic Approach

Our analytic approach focused on employing measures that should be largely unaffected by potential coding or payment system changes. To accomplish this, we relied heavily on data from preceding acute care stays during the six months prior to the IRF admission, assuming that the IRF PPS would have no effect on coding practices in the acute care setting.

Hypothesis 1: Change in the mix of patients admitted from acute care with specific costly conditions. The specific conditions we chose to examine in the IRF

population are ventilator dependence, dialysis, and organ transplant cases. These are conditions thought to be particularly expensive and it is of interest whether the IRF PPS is paying enough for these medically severe cases. Ventilator status increases cost for IRF cases by more than 25% and dialysis by 14% (Table 4.4, Carter et al., 2002). RAND's Technical Expert Advisory Panel suggested that organ transplants may be associated with high rehabilitation costs not accounted for in the IRF PPS, and they were examined for this reason.

We identified cases with these conditions using the bills for the acute care stay preceding the IRF stay to avoid potential problems with differences in coding of comorbidities in the 1999 versus 2002 IRF data. Ventilator cases were divided into three groups and identified as follows: (a) all cases with continuous mechanical ventilation for 96 consecutive hours or more in their preceding acute care stay (procedure code 96.72); (b) continuous mechanical ventilation support of either an unspecified duration or for less than 96 consecutive hours (procedure codes 96.70 and 96.71) with a primary diagnosis of a respiratory condition in their preceding acute care stay, as defined by multiple diagnosis category (MDC 4); and (c) continuous mechanical ventilation support of either an unspecified duration or for less than 96 consecutive hours and not having a primary respiratory diagnosis in their preceding acute care stay. Dialysis cases are identified by having procedure codes 39.95, 54.98, 39.42, 38.95, and 39.27 in the claim for their preceding acute care stay. Organ transplant cases are identified by acute procedure codes for lung (33.50, 33.51 33.52), combined heart/lung (3.36), heart (37.5), bone marrow (41.00, 41.01, 41.02, 41.03, 41.04, 41.05, 41.06), intestine (46.97), liver (50.59), pancreas (52.80, 52.82) and kidney (55.69) transplants occurring in any of the acute care stays

during the six months prior to IRF admission, since transplant cases may have repeated visits to an acute care facility between their transplant and the IRF admission.

Our analysis of the possible change in patient mix occurred in two steps. First, using the acute care bills, we identified all cases that had these conditions. We linked these acute care stays with Medicare-covered stays in IRFs, home health care agencies, skilled nursing facilities, and long-term care hospitals occurring within 30 days of the acute care stay discharge. We then examined 30-day post-acute care destinations for these cases to assess whether, for the years 1999 through 2002, any changes occurred in the number and percent of cases going to IRFs following acute care. Second, we examined the number and percent of IRF cases having these conditions during this time period, with a particular focus on identifying changes pre- and post- the IRF PPS implementation in 2002.

Hypothesis 2: Reduced admission rates for more severe cases. We examined this hypothesis for cases of all conditions as well as for the three patient subpopulations reflecting the most frequently treated conditions in IRFs, namely hip fracture, lower extremity joint replacement, and stroke. To avoid confounding due to changes in patient classification following IRF PPS implementation, we defined these three groups using information from the preceding acute care stay. Hip fracture was defined using a principal inpatient diagnosis of "fractures of the neck of the femur (diagnosis codes 820.xx)". Hip fracture patients who were listed as having metastases to the bone or who suffered major trauma to a site other than a lower extremity were excluded from the sample so as to create a clinically uniform group of patients. Lower extremity joint replacement was defined using the diagnosis-related groups (DRGs) for joint replacement

procedures (209, 471) minus those patients classified above as hip fracture. Stroke was defined as intracerebral hemorrhage (431.xx), occlusion and sterosis of precerebral arteries with infarction (433.x1), occlusion of cerebral arteries with infarction (434.x1), and acute but ill-defined cerebrovascular disease (436.xx).

We would expect more severe cases to require longer lengths of stay, to be more costly, and to have lower functional status than less severe cases. Since the IRF PPS recognizes differences in cost due to case-mix differences, we would expect that, if selection were occurring, IRFs might select less severe patients within case-mix groups in order to maximize profit. Thus, we defined several measures of severity conditional on case-mix group assignment as follows. Using length of stay to demonstrate, we computed the average length of stay for each CMG and comorbidity group (i.e., whether a case is or is not in one of the three comorbidity tiers)[2]. We then derived an indicator variable of whether a case is above or below the average for its own CMG-comorbidity group. Cases that are above the CMG-comorbidity group average were defined to be more severe. We created additional severity indicator variables for cost and FIM™ scores (motor, cognitive, and total scores). We also examined two additional measures of severity that are not conditional on case-mix group membership: mortality rates as of 30 and 150 days post-IRF admission.

Ideally, we would have directly compared these measures for the 1999 and 2002 cases to assess changes in patient severity; however, there are several complications that prevented this from being a valid approach. First, FIM™ scores are expected to be lower

[2] We could have defined similar groups of patients according to CMG-comorbidity tier assignment, but found that CMG-comorbidity tier groups that corresponded to the highest comorbidity tiers often had extremely low sample sizes; thus, our definition allowed us to capture the variability among patients with versus those without comorbidities.

in 2002 because of changes in data collection instructions and the incentive posed by the IRF PPS to code impairment more thoroughly; thus, a given FIM™ score could have different meanings in 1999 versus 2002. Second, length of stay has been trending downward for years; any change in length of stay between 1999 and 2002 could be attributable to pre-existing trends rather than to patient severity. Cost per case could be decreasing along with length of stay. Finally, changes in the average acute care length of stay could hasten IRF admission in some years relative to others, thereby making the 30- or 150- day windows following IRF admission reflect different time periods in a patient's recovery and thus make mortality rates less comparable across time.

In order to derive severity measures for 1999 and 2002 that are directly comparable, we used a logistic regression model to predict severity as a function of case-mix characteristics. We fit the logistic regression model to the 1999 matched bill-FIM™ data and made predictions for the universe of cases in 2002 and for the non-matched cases in the 1999 data, resulting in predicted severity measures for the universe of cases in 1999 and 2002 that are comparable[3]. The standard errors of the predicted severity estimates in 1999 and 2002 were estimated using the delta method to account for the variability in the predictions.

[3] Even using this strategy, however, we cannot completely rule out the possibility of unobserved selection because patient selection could occur within the covariate categories defined by our prediction models.

Logistic regression models were fit to the data to derive predicted severity measures for each of the seven dependent variables; these seven dependent variables were:an indicator of having a length of stay that is greater than the average given a case's CMG-comorbidity group; an indicator of having a cost per case that is greater than the CMG-comorbidity group average; an indicator of having a functional status score (motor, cognitive, or total FIM™ score) that is above the CMG-comorbidity group average; and mortality within 30 or 150 days following IRF admission. We used the following patient-level characteristics as covariates in our logistic regression models: race (white versus nonwhite); gender; age; comorbidities and complications from the preceding acute care stay; number of acute care stays during the six months prior to IRF admission; characteristics of the acute care hospital in which the discharged patients had their preceding acute care stay (namely, average daily census, case-mix index, disproportionate share of low-income patients, Medicaid utilization rate, number of beds, operating wage index, and urban/rural status); diagnosis-related group (DRG) from the preceding acute care stay[4]; and geographic region (state or census region[5]). Data on comorbidities came from the preceding acute care stay, provided that it occurred in the six months prior to the rehabilitation stay. The comorbidites included in our model were identified by Iezzoni et al. (1994) as conditions that are nearly always present prior to hospital admission and hence are extremely unlikely to represent complications arising during the hospitalization. These conditions included primary cancer with poor

[4] We included those DRGs that had at least 1 percent prevalence in both the 1999 fitting sample and in the 2002 prediction sample.

[5] State was used as a predictor whenever there were a sufficient number of observed events in the data to allow for it such that the resulting model would be parsimonious. Census region was used to predict post-IRF admission mortality for the stroke, hip fracture, and lower extremity joint replacement samples, due to the relatively small proportion of deaths reported. The 30-day mortality rate in the joint replacement sample was very low, making it difficult to obtain a stable model fit with numerous predictors in the model; thus, geographic region and characteristics of the prior acute stay are omitted from this model.

prognosis, metastatic cancer, chronic pulmonary disease, coronary artery disease, congestive heart failure, peripheral vascular disease, diabetes mellitus with and without end-organ damage, chronic renal failure, nutritional deficiencies, dementia, and functional impairment. All of these comorbidities were included in the logistic regression models for the entire sample; for separate analyses of each tracer condition, the following modifications were made to this list: The hip fracture models excluded metastatic cancer and chronic renal failure; the lower extremity joint replacement models excluded primary cancer with poor prognosis, metastatic cancer, diabetes mellitus with end-organ damage, chronic renal failure, nutritional deficiencies, and dementia; and the stroke models excluded cancer with a poor prognosis, metastatic cancer, and chronic renal failure.

Complications that were likely to have arisen during the acute care hospital stay were also examined. To develop this list, we began with the list of complications developed by Iezzoni et al. (1994) and adapted it, keeping only those complications that were likely to have continued to affect the patient at the time of acute care discharge and therefore to have influenced whether a patient sought post-acute care. For example, we excluded from the list transient metabolic derangements and side effects of medications. We augmented the list by adding important complications for the Medicare population that had been omitted from Iezzoni's list (for example, Iezzoni's list excluded stroke (for non-stroke patients), delirium, and acute renal failure). The complications that we used in our final analyses included post-operative pulmonary compromise, post-operative gastrointestinal hemorrhage, cellulitis or decubitus ulcer, pneumonia, mechanical complications due to a device, implant, or graft, shock or arrest in the hospital, post-

operative acute myocardial infarction, shock/cardiorespiratory event, venous thrombosis and pulmonary embolism, acute renal failure, delirium, stroke (for non-stroke patients only), hip fracture (for non-hip fracture patients only), iatrogenic complications, and sentinel events. We considered adding 43 complications to the models, but retained only those for which at least one percent of cases in 1999 and 2002 had the complication for each tracer condition as well as for the entire sample.

Hypothesis 3: Lower intensity of care. We compared the predicted severity measures for having above-average length of stay and cost per case derived as described above for Hypothesis 2 to the observed percentages of cases having above-average lengths of stay and costs relative to their CMG-comorbidity groups. Declines in the observed resource use measures in 2002 versus 1999, or greater differences in observed resource use than in predicted resource use in 2002 versus 1999, could suggest that providers are stinting on care in response to prospective payment.

5. RESULTS

Hypothesis 1: Following the IRF PPS implementation, fewer patients with particularly costly conditions will be admitted from acute care.

Table 1 shows the number and percent of cases leaving acute care for various post-acute care destinations, including IRFs, within 30 days of being discharged from an acute care hospital, for 1999-2002. The percentage of acute care patients discharged to IRFs is relatively steady during 1999 through 2002 for all of the conditions listed on Table 1 except for patients without a primary respiratory diagnosis who require less than 96 hours of ventilator support during their acute stay, whose rate of discharge to IRFs

increased from 7.4% to 8.4%. While all of these rates held steady or increased, the absolute numbers of patients discharged to IRFs increased between 1999 and 2002 for all conditions. The percentage of these acute care cases receiving no formal Medicare-covered care 30 days following the acute stay, denoted by "None of the above" in Table 1, remained steady during 1999 through 2002 for all conditions except organ transplant cases, which increased by 3.4 percentage points between 1999 and 2002.

Table 2 shows the number and percent of IRF cases with selected conditions as defined by their preceding acute care stay (or in any acute care stay for the organ transplant cases) during the six months prior to IRF admission. The numbers of cases in the entire IRF population and for each condition increase until 2002, though the percent of IRF cases with each condition either holds steady or very slightly decreases across the years for each condition listed in Table 2. Tables 1 and 2 combined suggest that no major changes are occurring with respect to realized access to IRF care for patients with these conditions.

Hypothesis 2: More severe cases will have reduced admission rates under the IRF PPS. Specifically, relatively severe patients within case-mix and comorbidity groups may experience reduced access to IRF care.

Table 3 shows the percent of patients in 1999 and 2002 predicted to be more severe than other patients in their CMG and comorbidity group based on length of stay, cost, and FIM™ scores, as well as predicted probabilities of death within 30 and 150 days of IRF admission. We examined predicted severity on all conditions as well as separately for stroke, hip fracture, and lower extremity joint replacement patients. In 1999, 42.9% of the cases were predicted to have a length of stay greater than the average length of stay

for their CMG and comorbidity status, while, in 2002, 43.3% of the cases were predicted to have greater than average length of stay. These years differed by 0.4 percentage points, or a 1.1 percent increase. The small difference suggests that there was not a meaningful change with respect to this severity measure between 1999 and 2002; given the large sample size, almost all of our comparisons, including this one, are statistically significant, and we therefore note on the table those results that are not statistically significant at the p=0.001 level. The greater than average cost indicator suggests that patients were more severe in 2002, with increases ranging from 3.6 to 4.1 percent for the conditions shown on Table 3, suggesting that cases in 2002 were slightly more severe than those in 1999. The differences between 1999 and 2002 with respect to the percentages of cases that are more severe, based on having lower predicted FIM™ scores, ranged from -1.2 to -1.9 percent for the universe (or, a range of 0.5-0.8 points on the FIM™ score scale), indicating that cases were relatively comparable with respect to these severity measures. The largest differences were seen for the measure of high probability of death (150 days post-IRF admission); the lower percentage in 2002, 9.9 percent, suggests that patients in that year are slightly less severe than those in 1999, where the predicted probability of death was 10.6 percent. This result, combined with the finding that patients were predicted to have relatively higher costs, suggests that better functioning patients who are most likely to benefit from inpatient rehabilitation care are increasingly being seen following IRF PPS implementation. The results for stroke, hip fracture, and lower extremity joint replacement patients largely mirror those of the full sample, though the differences with respect to predicted FIM™ cognitive score and total score and death probabilities are less than what is observed for the full sample.

The final column on Table 3 provides the c-statistic for each logistic regression prediction model from which the severity measure is predicted. The c-statistic is a measure of the predictive ability of the model; its range is 0.5 (for no predictive ability) to 1 (for perfect predictive ability). Most of the c-statistics on Table 3 are in the range of 0.6-0.7, indicating that these models have relatively low predictive performance; models with c-statistics below 0.6 are particularly poor predictors. This relatively low predictive performance is not surprising given that we have already conditioned on CMGs and comorbidity status, as these were designed to reflect the relative severity of cases. The models of probability of death have better predictive power, with c-statistics over 0.7 for most of the mortality outcomes.

We verified that the relationship between predicted severity in 1999 and 2002 held for a constant set of IRFs that were in our samples for both of these years. The results were quite similar to those presented in Table 3 and thus we do not include them here. Based on this finding, we conclude that changes in the set of IRFs that treated patients between 1999 and 2002 do not explain the differences between the two years.

Hypothesis 3: Patients will receive a lower intensity of care under the IRF PPS.

Reductions in resource use, as indicated by length of stay and cost per case, could be indicative of moral hazard effects. Our analytical strategy to explore this hypothesis was to compare observed percentages of cases having greater than average length of stay and cost per case versus predictions of these quantities to assess whether cases may be inappropriately receiving lower levels of care. This analysis was constrained to the matched sample cases, since CMG assignments can only be made for the cases with FIM™ data. We therefore had to confirm that the sample of cases in 1999 could be

compared to that of 2002. The first two sets of columns of Table 4 show that the 1999 and 2002 samples can indeed be compared for this analysis – the predicted proportions of relatively severe cases in the 1999 and 2002 universe agree with those for the samples, suggesting that the case mix of the sample and universe agree in each year. Next, we compared the predicted proportions of cases with relatively large length of stay and cost (middle two columns of Table 4) to the observed proportions (last two columns of Table 4). The observed percent of more severe patients in 2002 is much lower than the predicted percent; while the predicted percent of cases with greater than average lengths of stay in the 2002 sample is 43.4 percent, the observed proportion is much lower at 30.3 percent. Smaller, though noticeable, decreases in the percentage of patients having greater than average cost per case are observed for the entire sample and for stroke, hip fracture, and lower extremity joint replacement (Table 4). Before concluding that these observed decreases in length of stay and cost are strictly due to the IRF PPS, the presence of prior trends in these measures must be considered. Figure 1 shows the trend in the average length of stay for the universe of IRF cases during 1998 through 2002. Length of stay fell steadily during 1998 through 2000, and it fell slightly more sharply between 2001 and 2002. Declines in length of stay had also been seen in the early 1990s; length of stay declined by 5.5% during 1990 through 1995 (MedPAC, 1998, Chart 4-17).

In addition to examining the relative severity of patients, we also compared the observed averages of length of stay, cost per case, age, and mortality rates for 1999 versus 2002 for the IRF universe. Table 5 shows the observed mean values of the variables from which the measures of being a more severe case were derived as well as two age-based severity measures for the universe. As expected, average lengths of stay

decreased by 2002 for all conditions. Average costs per case were lower in 2002 for the entire universe and for the stroke cases. IRF cases are younger in 2002 than 1999 by about half a year, which holds for all three of the tracer conditions as well as for the entire sample. There were very slight decreases in post-IRF admission mortality rates in 2002.

6. DISCUSSION

The severity measures presented here suggest that true case mix, both within and across case-mix groups, remained relatively constant between 1999 and 2002, as indicated by the similarity of the prevalence of specified conditions shown in Tables 1 and 2 and by the similarity of predicted probabilities of relatively more severe patients in 1999 and 2002. Thus, realized access to IRF care appears to have been maintained following IRF PPS implementation. The predicted severity measures showed only slight differences between what was observed in 1999 versus 2002, suggesting that patients had only a bit less severity in 2002 versus 1999. The most noticeable differences are that cases were predicted to have higher costs per case under the IRF PPS versus pre-IRF PPS, indicating greater resource use needs. Interestingly, cases in 2002 were predicted to have lower probabilities of death versus those in 1999, suggesting that higher functioning cases that could benefit from inpatient rehabilitation care – and thus required greater resources for recovery – were increasingly being admitted under the IRF PPS.

The observed average length of stay is considerably lower in 2002 for the entire sample as well as for stroke, hip fracture, and lower extremity joint replacement cases; patients were also younger in 2002 and had slightly lower mortality rates in 1999 versus

2002. We found that hip fracture and joint replacement patients were more expensive in 2002 versus 1999 on average, but they were not necessarily more expensive than similar patients had been in 1999; this could be due to shifts that occurred in the proportion of cases admitted to higher-weighted CMGs following IRF PPS implementation that could have moved patients into more expensive CMGs (Carter and Paddock, 2005). Overall, the severity measures suggest that patients really were not meaningfully more severe in 2002 versus 1999.

Decreases in the actual average lengths of stay between 1999 and 2002 were observed, in contrast to the similarity of the predicted proportions of patients expected to have larger than average length of stay and cost per case in 1999 versus 2002. Length of stay has been trending downward over recent years, with the trend moving further downward after 1999. This overall trend does not suggest an abrupt response to the IRF PPS. Thus, the change between 1999 and 2002 for length of stay appears to have been part of a trend that began prior to 2002. It is possible, however, that changes could have occurred in anticipation of the IRF PPS or in response to other post-acute payment systems that went into effect around that time.

We did not find evidence that patients treated at IRFs were appreciably more or less severe following the IRF PPS implementation versus beforehand. Despite this, we have found that FIM™ scores decreased in 2002 versus 1999 (Beeuwkes Buntin et al., 2005) and other, similar manifestations of coding change have occurred (Carter and Paddock, 2005). Future refinements to the IRF PPS should account for the discrepancies between predicted and observed severity.

Limitations of this study are (a) the models we used to predict relative severity had only fair predictive ability, and (b) the possibility remains that these results are biased due to the occurrence of unobserved selection not captured by the covariates of our model. However, we believe that it is unlikely that providers would be selecting on patient characteristics that are unrelated to the observable covariates included in our models and simultaneously not selecting on observables that are predictive of outcomes. Year-to-year variability in trends warrants continued monitoring of the effects of the IRF PPS.

REFERENCES

Angelelli J, Gifford D, Intrator O, Gozalo P, Laliberte L, Mor V. Access to postacute nursing home care before and after the BBA. *Health Affairs.* 2002;21(5):254-64.

Beeuwkes Buntin M, Carter GM, Hayden O, Hoverman C, Paddock SM, Wynn BO. IRF Care Use Before and After Implementation of the IRF PPS. TR-257-CMS, Santa Monica, CA: RAND; 2005

Carter GM, Beeuwkes Buntin M, Hayden O, Kawata JH, Paddock SM, Relles DA, Ridgeway GK, Totten M, Wynn BO. *Analyses for the Initial Implementation of the Inpatient Rehabilitation Facility Prospective Payment System.* MR-1500-CMS. Santa Monica, CA: RAND; 2002.

Carter GM, Newhouse JP, Relles DA. *Has DRG Creep Crept Up?: Decomposing the Case Mix Index Change Between 1987 and 1988.* R-4098-HCFA/ProPAC. Santa Monica, CA: RAND; 1991.

Carter CM, Paddock SM. Preliminary Analyses of Changes in Coding and Case Mix under the Inpatient Rehabilitation Facility Prospective Payment System. TR-213-CMS, Santa Monica, CA: RAND; to appear.

Chan L, Koepsell TD, Deyo RA, Esselman PC, Haeselkorn JK, Lowery JK, Stolov WC. The effects of Medicare's payment system for rehabilitation hospitals on length of stay, charges, and total payments. *N Engl J Med.* 1997;337(14):978-85.

Ellis RP, McGuire TG. Hospital response to prospective payment: moral hazard, selection, and practice-style effects. *J Health Econ.* 1996;15:257-77.

Iezzoni LI, Daley J, Heeren T, Foley SM, Fisher ES, Duncan C, Hughes JS, Coffman GA. Identifying complications of care using administrative data. *Med Care.* 1994;32(7):700-15.

Kahn KL, Draper D, Keeler EB, Rogers WH, Rubenstein LV, Kosecoff JB, Sherwood MJ, Reinisch EK, Carney M, Kamberg CJ, Bentow SS, Wells KB, Allen HM, Reboussin D, Roth CP, Chew CF, Brook RH. *The Effects of the DRG-based Prospective Payment System on Quality of Care for Hospitalized Medicare Patients: Final Report.* R-3931-HCFA. Santa Monica, CA: RAND; 1991.

Medicare Payment Advisory Commission (MedPAC). *Health Care Spending and the Medicare Program: A Data Book.* Washington, DC: MedPAC; 1998.

Neu CR, Harrison S. *Posthospital Care Before and After the Medicare Prospective Payment System.* R-3590-HCFA. Santa Monica, CA: RAND; 1988.

Newhouse JP. Do unprofitable patients face access problems? *Health Care Financ R.* 1989;11(2):33-42.

Newhouse JP, Cretin S, Witsberger CJ. Predicting hospital accounting costs. *Health Care Financ R.* 1989;11(1):25-33.

Stineman MG. Prospective payment, prospective challenge. *Arch Phys Med Rehab.* 2002;83:1802-05.

Uniform Data System for Medical Rehabilitation. *The Guide for the Uniform Data Set for Medical Rehabilitation* (Including the FIM™ Instrument), Version 5.1 Buffalo: UDSmr; 1999.

Yip JY, Wilber KH., Myrtle RC. The impact of the 1997 Balanced Budget amendment's prospective payment system on patient case mix and rehabilitation utilization in skilled nursing. *Gerontologist.* 2002;42(5):653-60.

Table 1: Post-acute care destinations of persons with specified conditions, number and percent of cases, 1999-2002

Ventilator support for 96+ hours

Post-Acute Care Discharge Destination	1999 # cases / %	2000 # cases / %	2001 # cases / %	2002 # cases / %
Home health care	8476 17.2	8564 17.0	8210 15.8	8653 15.4
IRF	5608 11.4	5858 11.6	5797 11.2	6289 11.2
Skilled nursing facility	17862 36.3	18104 36.0	18495 35.6	20092 35.7
Inpatient rehabilitation in acute setting	83 0.17	86 0.17	74 0.14	54 0.10
Long term care	6054 12.3	6729 13.4	7679 14.8	9028 16.1
None of the above	11123 22.6	10992 21.8	11639 22.4	12112 21.5

Primary respiratory diagnosis with other ventilator support

Post-Acute Care Discharge Destination	1999 # cases / %	2000 # cases / %	2001 # cases / %	2002 # cases / %
Home health care	8439 24.8	7881 24.0	7205 22.0	7798 22.5
IRF	1328 3.91	1344 4.10	1383 4.23	1458 4.20
Skilled nursing facility	8831 26.0	8588 26.2	8647 26.4	9292 26.8
Inpatient rehabilitation in acute setting	26 0.08	16 0.05	15 0.05	8 0.02
Long term care	825 2.43	880 2.68	924 2.82	1082 3.1
None of the above	14540 42.8	14088 43.0	14544 44.5	14979 43.3

Non-primary respiratory diagnosis with other ventilator support

Post-Acute Care Discharge Destination	1999 # cases / %	2000 # cases / %	2001 # cases / %	2002 # cases / %
Home health care	16539 24.6	16524 23.9	15921 21.9	16371 21.7
IRF	4993 7.41	5428 7.85	5847 8.05	6287 8.4
Skilled nursing facility	17295 25.7	17766 25.7	19015 26.2	19819 26.3
Inpatient rehabilitation in acute setting	90 0.13	78 0.11	69 0.1	58 0.08
Long term care	1535 2.28	1833 2.65	2087 2.87	2627 3.5
None of the above	26902 39.9	27540 39.8	29667 40.9	30144 40.0

Organ transplant

Post-Acute Care Discharge Destination	1999 # cases / %	2000 # cases / %	2001 # cases / %	2002 # cases / %
Home health care	1812 22.8	1915 22.3	2136 20.4	2225 76.8
IRF	141 1.77	166 1.93	172 1.65	216 1.9
Skilled nursing facility	134 1.68	136 1.58	154 1.47	141 1.3
Inpatient rehabilitation in acute setting	5 0.06	4 0.05	2 0.02	2 0.02
Long term care	26 0.33	17 0.20	22 0.21	32 0.28
None of the above	5836 73.4	6364 74.0	7968 76.2	8667 76.8

Dialysis

Post-Acute Care Discharge Destination	1999 # cases / %	2000 # cases / %	2001 # cases / %	2002 # cases / %
Home health care	25747 17.6	26276 17.1	25504 15.3	27434 15.6
IRF	5175 3.54	5784 3.77	6123 3.67	6269 3.6
Skilled nursing facility	17626 12.1	18957 12.4	21181 12.7	23978 13.6
Inpatient rehabilitation in acute setting	69 0.05	85 0.06	70 0.04	51 0.03
Long term care	1835 1.25	2212 1.44	2891 1.73	3494 1.98
None of the above	95821 65.5	100018 65.2	110975 66.6	115092 65.3

Table 2: Number and Percent of Cases Seen in IRFs with Particular Conditions, 1999-2002

Condition	1999 # cases / %	2000 # cases / %	2001 # cases / %	2002 # cases / %
Ventilator support for 96+ hours	7114 1.8	7264 1.8	7142 1.6	7663 1.6
Primary respiratory diagnosis with other ventilator support	1460 0.4	1439 0.3	1453 0.3	1584 0.3
Non-primary respiratory diagnosis with other ventilator support	5464 1.4	5859 1.4	6238 1.4	6637 1.4
Organ Transplant	290 0.1	322 0.1	353 0.1	423 0.1
Dialysis	10583 2.7	11374 2.7	11922 2.7	11631 2.5
Total IRF cases with a preceding acute stay in last 6 months	370405 95.2	396079 95.6	428375 95.9	455487 96.2
Total IRF cases	389266 100	414494 100	446532 100	473696 100

Table 3: Predicted proportions of inpatient rehabilitation patients who are severe

Entire Sample	1999 %	2002 %	% Change from 1999	Std. Error of Change	C statistic
Longer length of stay	42.9	43.3	1.1	0.0023	0.624
Greater cost per case	41.1	42.4	3.3	0.0023	0.632
Lower FIM™ motor score	49.9	49.3	-1.2	0.0024	0.555
Lower FIM™ cognitive score	42.0	41.2	-1.9	0.0023	0.634
Lower FIM™ total score (motor + cognitive)	45.8	45.3	-1.2	0.0023	0.590
Greater probability of death (30 days)	2.9	2.7	-6.3	0.0008	0.734
Greater probability of death (150 days)	10.6	9.9	-7.4	0.0013	0.738
Sample size of prediction samples	363542	446002			
Stroke	**1999 %**	**2002 %**	**% Change from 1999**	**Std. Error of Change**	**C statistic**
Longer length of stay	46.1	46.9	1.6	0.0145	0.624
Greater cost per case	44.6	46.3	3.6	0.0146	0.622
Lower FIM™ motor score	50.5	50.2	-0.7	0.0147	0.568
Lower FIM™ cognitive score	49.4	49.9	1.0	0.0143	0.610
Lower FIM™ total score (motor + cognitive)	47.9	48.3	0.7	0.0145	0.600
Greater probability of death (30 days)	3.0	2.9	-1.8	0.0035	0.651
Greater probability of death (150 days)	10.7	10.5	-1.6	0.0058	0.655
Sample size of prediction samples	58798	57379			
Hip Fracture	**1999 %**	**2002 %**	**% Change from 1999**	**Std. Error of Change**	**C statistic**
Longer length of stay	45.6	45.5	-0.3	0.0193	0.659
Greater cost per case	44.8	46.4	3.6	0.0200	0.657
Lower FIM™ motor score	51.1	50.5	-1.2	0.0202	0.574
Lower FIM™ cognitive score*	45.0	44.9	-0.1	0.0196	0.658
Lower FIM™ total score (motor + cognitive)	46.9	46.5	-0.8	0.0198	0.633
Greater probability of death (30 days)	2.0	2.0	1.4	0.0046	0.710
Greater probability of death (150 days)	7.9	7.8	-0.9	0.0089	0.720
Sample size of prediction samples	41557	45688			
Lower Extremity Joint Replacement	**1999 %**	**2002 %**	**% Change from 1999**	**Std. Error of Change**	**C statistic**
Longer length of stay	41.6	41.9	0.7	0.0099	0.665
Greater cost per case	39.0	40.6	4.1	0.0101	0.680
Lower FIM™ motor score	46.2	45.8	-0.8	0.0104	0.567
Lower FIM™ cognitive score	30.7	30.3	-1.1	0.0097	0.615
Lower FIM™ total score (motor + cognitive)	40.6	40.0	-1.5	0.0103	0.570
Greater probability of death (30 days)	0.3	0.3	-2.3	0.0007	0.680
Greater probability of death (150 days)	1.1	1.1	-3.0	0.0018	0.723
Sample size of prediction samples	71480	107124			

* The change is not statistically significant ($p<0.001$).

Table 4: Comparison of the predicted percent of more severe cases with respect to length of stay and cost per case. Number and percent of cases

Entire sample		Predictions for universe		Predictions for sample		Observed for sample	
		1999	2002	1999	2002	1999	2002
Longer length of stay	n	363542	446002	240636	432865	240636	432865
	%	42.9	43.3	42.9	43.4	42.9	30.3
Greater cost per case	n	363542	446002	234393	423717	234393	423717
	%	41.1	42.4	40.6	42.4	40.6	36.1
Stroke		**Predictions for universe**		**Predictions for sample**		**Observed for sample**	
		1999	**2002**	**1999**	**2002**	**1999**	**2002**
Longer length of stay	n	58798	57379	38952	55635	38952	55635
	%	46.1	46.9	46.3	46.9	46.3	35.5
Greater cost per case	n	58798	57379	37980	54432	37980	54432
	%	44.6	46.3	44.2	46.2	44.2	40.6
Hip Fracture		**Predictions for universe**		**Predictions for sample**		**Observed for sample**	
		1999	**2002**	**1999**	**2002**	**1999**	**2002**
Longer length of stay	n	41557	45688	26621	44390	26621	44390
	%	45.6	45.5	45.4	45.5	45.4	32.0
Greater cost per case	n	41557	45688	25927	43480	25927	43480
	%	44.8	46.4	44.1	46.4	44.1	39.5
Lower Extremity Joint Replacement		**Predictions for universe**		**Predictions for sample**		**Observed for sample**	
		1999	**2002**	**1999**	**2002**	**1999**	**2002**
Longer length of stay	n	71480	107124	48432	104330	48432	104330
	%	41.6	41.9	41.7	41.7	41.7	27.0
Greater cost per case	n	71480	107124	46952	102078	46952	102078
	%	39.0	40.6	38.4	38.4	38.4	35.1

Table 5: Observed mean values of severity indicators in universe, 1999 and 2002

Entire Sample	1999 Mean	2002 Mean	Change since 1999	Percent change
Length of stay, days	14.83	13.02	-1.81	-12.2
Cost per case	11180.18	10792.78	-387.40	-3.5
Age (years)	75.98	75.53	-0.45	-0.6
Is the patient older than 85 years?	0.1463	0.1315	-0.0149	-10.2
Mortality (30 days post-IRF admission)	0.0282	0.0252	-0.0030	-10.7
Mortality (150 days post-IRF admission)	0.1034	0.0924	-0.0109	-10.6
Stroke	**1999 Mean**	**2002 Mean**	**Change since 1999**	**Percent change**
Length of stay, days	19.11	17.30	-1.81	-9.5
Cost per case	14913.13	14780.84	-132.29	-0.9
Age (years)	76.50	76.07	-0.43	-0.6
Is the patient older than 85 years?	0.1442	0.1343	-0.0100	-6.9
Mortality (30 days post-IRF admission)*	0.0296	0.0265	-0.0031	-10.4
Mortality (150 days post-IRF admission)	0.1069	0.0987	-0.0082	-7.6
Hip Fracture	**1999 Mean**	**2002 Mean**	**Change since 1999**	**Percent change**
Length of stay, days	15.31	14.00	-1.31	-8.5
Cost per case	10998.36	11224.04	225.68	2.1
Age (years)	80.84	80.26	-0.58	-0.7
Is the patient older than 85 years?	0.3026	0.2751	-0.0275	-9.1
Mortality (30 days post-IRF admission)*	0.0199	0.0194	-0.0005	-2.6
Mortality (150 days post-IRF admission)*	0.0791	0.0798	0.0007	0.9
Lower Extremity Joint Replacement	**1999 Mean**	**2002 Mean**	**Change since 1999**	**Percent change**
Length of stay, days	10.03	9.16	-0.88	-8.8
Cost per case	7320.74	7472.99	152.25	2.1
Age (years)	74.30	73.57	-0.73	-1.0
Is the patient older than 85 years?	0.0570	0.0466	-0.0104	-18.2
Mortality (30 days post-IRF admission)*	0.0028	0.0025	-0.0003	-9.9
Mortality (150 days post-IRF admission)*	0.0114	0.0104	-0.0009	-8.3

* Change is not statistically significant ($p > 0.001$).

Figure 1. Average Length of Stay of IRF Cases, 1998-2002